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Getting the Most Out of Your Machine Tool Dollar

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It is pointed out that production guaranties must be met under average conditions rather than only under especially favorable ones. The purchaser must make allowances for actual conditions if he has any doubt of the builder or his salesman having done so

WHEN the machine tool builder guarantees a certain production per hour on new machines he has to offer, he very often specifies a rate of production that can only be maintained under the most ideal conditions, without taking into consideration the time allowance for grinding or resetting tools, minor repairs and adjustments on the machine. Allowances for these items must be made by the production man. The extent of this allowance involves his judgment and his experience with the particular machine tool builder. Quite naturally the latter will say that he is unable to visualize all of the conditions in the plant of the manufacturer but it seems reasonable that he should have a sufficient factor of safety in his estimate to provide for the usual shop troubles. Because of extremely keen competition, he wants to present the best possible picture but in the long run both he and the manufacturer are benefited by a conservative estimate of a machine's capacity rather than one that provides for a production that cannot be maintained day after day.

Our practice is to discount the estimates liberally, particularly when deciding to replace existing equipment for the purpose of reducing direct labor cost on the parts involved. A machine, even though it may be quite old and of an obsolete design, if it is producing parts up to the standard of quality day after day is an asset that in our practice is not replaced unless the points in favor of new machines are worth while after having their advantages evaluated in our own analysis. An enthusiastic salesman sometimes makes promises or guaranties for his equipment that are difficult to fulfill.

In deciding whether to purchase new production equipment, we are governed primarily by the possible reduction in direct labor. An important factor, however, in accomplishing this is the necessity of eliminating highly skilled operators. The type of machine that is particularly interesting to us is the one that after being loaded by the operator goes through its functions and then stops in the unloading position. There has, of course, been some development of entirely automatic machines for handling certain classes of work but there are now a great many cases where machines require the constant attention of an operator.

Generally speaking we do not want single-purpose machines. There are, however, instances where the savings obtainable by the installation of this type of equipment are so attractive that we can afford to deviate from this policy. In such cases, we must be convinced that the single-purpose machine will pay for itself in a comparatively short time, the length of time being governed somewhat by the possibility of changes in design of parts for which the machine is being considered.

There is still, in our opinion, opportunity for considerable improvement in the average machine tool in the elimination of cast iron gears, cams and other parts subject to stresses and wear far beyond the capacity of soft iron. We have had cases where parts of machines were completely worn out inside of six months, and other cases where gears made of bronze or cast iron had to be replaced inside of thirty days because of failure of the machine tool builder to provide a sufficient factor of safety. There is also considerable room for improvement by the use of anti-friction bearings instead of a cheap grade of bronze in a good many instances. The lubricating systems on many machine tools are antiquated and the development in the direction of a central circulating oil system has been extremely slow. Many failures of parts are due to the lack of adequate lubrication that could easily be avoided if proper facilities had been built into the machines. We

are constantly calling the attention of foremen and operators to the necessity of oiling their machines but the tendency of the average operator is to pay little or no attention to this when he has to do so by the oil can method.

When new equipment other than standard machine tools is being considered we find that a great deal of time can be saved by having the builder's engineer accompany the salesman when calling on us. Many details of interest can in this way be settled promptly and very often the builder gets a new idea from the contact established by his engineer.

Orders for new equipment originate in the master mechanic's division on both replacement machines and equipment for any new production program.

Past Performance Counts

Machines are replaced when in need of repairs in excess of what, in the combined judgment of the production superintendent and the master mechanic's department, is justified by their past performance, when the quality of the product is below our standard, and when direct labor can be reduced materially. Daily contact with every department in our plants through field men who are known as trouble men enables the master mechanic's department to keep posted on the performance of every machine and to make provision to safeguard our production against delays and maintain schedules.

When a new production program is authorized by the management, the master mechanic's department on receipt of releases and drawings from the engineering department plans the sequence of operations and makes a thorough analysis of equipment made available by an adjustment of schedules as a whole, if any adjustment has taken place. The operation sheets are submitted to the production superintendent for his approval. These operation sheets show the type of equipment it is proposed to use, the capacity per hour and brief specifications of the fixtures, tools and gages that will be provided. Requisitions for machinery are then issued, on which proposals have, in most cases, been received while operation sheets were being challenged by the production superintendent.

Requisitions are forwarded with proposals to the purchasing department. The responsibility for obtaining deliveries of machines in time to meet a production schedule rests entirely with the master mechanic's department. In many cases very strenuous work on the part of follow-up men is required. In a few cases we have taken over a part of the machining for the machine tool builder in order to expedite the delivery. It is true that it is necessary occasionally to ask for deliveries that are hard to make but when machines are not shipped on time a production program in which a great deal of money is involved is in jeopardy, the seriousness of which the builder in most cases does not fully recognize.

After machines are received at our plants, the master mechanic's department is also responsible for getting them into operation up to the point of machining parts that pass inspection within the time allowed in the estimate. This is accomplished through the tool trouble men who cover the departments to which they are assigned and who from that point on take care of routine troubles. These men also are constantly checking the performance of the cutting tools with the view of determining on the best steel and the best grind for uniform results. In any production shop the selection of the proper equipment is highly important, but it is equally important to keep it operating at its full capacity over a period of years. With hundreds of machines in operation and lined up progressively, failure of any one to operate satisfactorily cannot be tolerated. The trouble men report to a foreman, who in turn reports to the supervisor of tools on matters requiring his attention. The supervisor is kept thoroughly informed on the operation of all departments.

The trouble men in most cases are selected from men available in the toolroom. They must be versatile mechanics able to run any machine in the shop if necessary and possess the right temperament for the job, so that they can carry on their work without friction with foremen or operators.

Maintenance of production machinery is handled through the machine repair department under the supervision of the supervisor of tools. The master mechanic is enabled by the control of all of what may be termed service departments to keep the equipment throughout the plants tuned up to meet production schedules.

[The proceding article is the eighteenth under the title, "Getting the Most Out of Your Machine Tool Dollar." The first article by J. A. Smith, General Superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second, by C. A. Shaffer, General Supervisor of Machinery and Tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, Vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, Managing Editor, *American Machinist*, outlining the policies of the International Harvester Co., was published an page 793, Vol. 62. The fifth, by G. T. Christopher, Factory Manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth, by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. The seventh, by T. C. Vail, superintendent, the Spicer Manufacturing Co., was published on page 175, Vol. 63. The eighth, by E. R. Norris, director of works equipment, the Westinghouse Electric and Manufacturing Co., was published on page 255, Vol. 63. The ninth, by Fred H. Colvin, Editor, *American Machinist*, was published on page 417, Vol. 63. The tenth, by Wm. Bailey, production manager, the Hoover Co., was published on page 917, Vol. 63. The eleventh, by G. S. McKee, assistant factory manager, the Timken Roller Bearing Co., was published on page 995, Vol. 63. The twelfth, by Wm. Hartman, superintendent, the National Cash Register Co., was published on page 1, Vol. 64. The thirteenth, by Percy S. Brown, works manager, the Corona Typewriter Co., Inc., was published on page 183, Vol. 64. The fourteenth, by M. H. Westbrook, shop superintendent, Grand Trunk Railway System, was published on page 261, Vol. 64. The fifteenth, by Jerome R. George, vice-president, Morgan Construction Co., was published on page 381, Vol. 64. The sixteenth, by W. S. Graham, works manager, Hupp Motor Car Corporation was published on page 697, Vol. 64. The seventeenth, by James E. Gleason, President and General Manager, Gleason Works, was published on page 809, Vol. 64. Other articles on the same subject will be published in forthcoming issues.]

An Inlaid Yard-Stick for Convenient Measuring

By Frank V. Faulhaber

Machinists who must do much measuring of light materials, such as wire, will find it a big time-saver to inlay a yard-stick in a bench, where it will always be available. The first procedure is to cut a neat, even groove in the bench with hammer and chisel, of just enough depth, width and length to admit the yard-stick snugly, so that it will rest flush with the bench. Some glue can be applied before inserting the stick, then a few tacks or small nails, can be used to hold it.

This arrangement will eliminate the necessity for the search of an elusive ruler; it cannot be borrowed; and it does away with waste, besides sparing the operator's patience. Aside from the measuring of wire, which can be conveniently done when coils of the material are nearby, many other materials can be measured, particularly where preciseness is not necessary.

The imbedded yard-stick eliminates its handling and does not interfere with other work.

The Screw Conveyor and Its Manufacture

By D. C. Wright

Different types of screw conveyors—The design of the sectional flight conveyor—Efficiency in manufacture—Methods of production for flight sections

SPIRAL or screw-like devices for conveying materials have been known and used for a great many years. Early sketches, from the time of Archimedes, show that the general principles of screw conveyors were understood by the engineers of the day. Since about the middle of the 19th century, this type of conveyor came into quite general use not alone for conveying purposes, but also for imparting a certain mixing action into the performance.

The construction of screw conveyors has ranged from wooden pegs driven into holes arranged spirally about a wooden shaft, to a cumbersome screw of cast metal. Because its action has proved so satisfactory for certain types of work, the earlier and cruder designs have been gradually improved until today it is possible to purchase very effective installations, designed on a sound basis of actual experience with the particular class of work and with the peculiar conditions to be met with in any given practice.

Because of the difference in requirements, different types of screw conveyors have been developed. Each particular type has its outstanding points of superiority over the others and each one is better than the others for the particular work for which it may be required. The different types of screw conveyors are:

Solid-cast
Sectional-cast
Sectional sheet-metal
Sectional-ribbon
Paddle
Helicoid or continuous-flight.

In addition to these main classifications there are also various combinations of these to meet special conditions or demands. These types are made in many different metals, in both single or double flight and with either right- or left-hand spirals, as in Fig. 1. When facing the conveyor if clockwise rotation would cause the material to be carried toward the observer, the conveyor is a right-hand one. If the material would be carried away from the observer, the conveyor is a left-hand one. The possible variety of screw conveyors is manifold.

As its name implies, the cast conveyor is made from patterns in regular green sand molds, the continuous flight conveyor as shown in Fig. 2 being cast in standard length sections with the exception of a single odd length usually required to make up the gross length. The sectional cast flight conveyor is manufactured in units comprising anywhere from a half to over a full turn of flight, with its center cored out to fit over a pipe or shaft or else to match in the form of a clamp coupling fastened over a shaft and matching another half section bolted opposite. In the case of those sections, as in Fig. 3, that have the full-cored holes, the ends are cast with a rough jaw to interlock and prevent

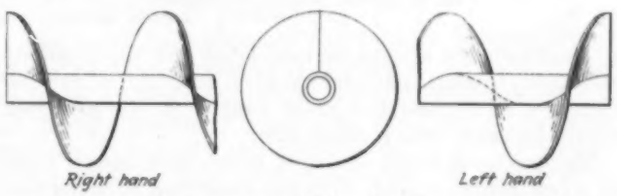


Fig. 1—Right- and left-hand screw conveyors

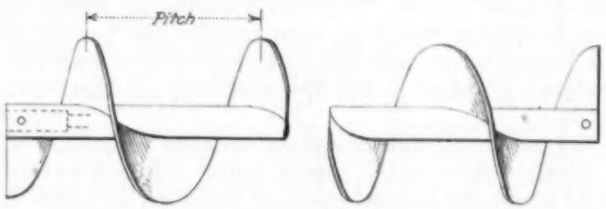


Fig. 2—The solid cast conveyor

turning and they also have a setscrew through the casting against the center supporting member. In order to give greater protection against the twisting of the shaft or backbone inside of the flights, the latter are often cored with a rectangular center form, as in Fig. 4. They are fitted to a square shaft of which only the ends are turned down for driving or bearing members.

This form of conveyor is naturally quite heavy when compared with other forms, but it will be found particularly useful for conditions demanding resistance to wear and to corrosive action. For the handling of acids, for example, cast iron will considerably outwear the best steel conveyor.

Assuming that the pattern, core and foundry work are done rightly and that the castings are clean and sharp, especially at their fitting surfaces, the manufacture of this type of conveyor consists merely in clamping the pieces together about the center shaft. The shaft must be previously drilled for the couplings and bearings as well as the driving members.

It is the standard practice of the conveyor manufacturer to adhere to uniform lengths which can be carried in stock as required. Odd lengths are utilized where it is necessary to make a line of some given length as in Fig. 5. In the case of the cast conveyor,

The first part of a three-part article. The second will appear in an early issue.

on account of the weight involved and the consequently greater load on the bearings and couplings, the regular lengths are made approximately one-half the lengths that would be standard for the corresponding sizes in sheet metal conveyors. For best results, the standard

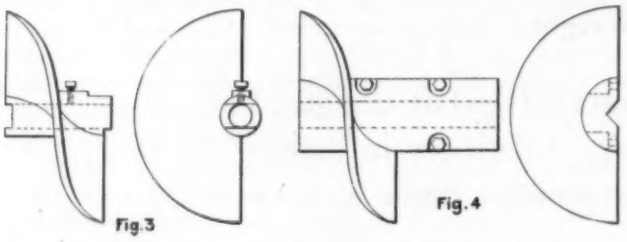


Fig. 3—Sectional cast conveyor for round core
Fig. 4—Sectional cast conveyor for square core

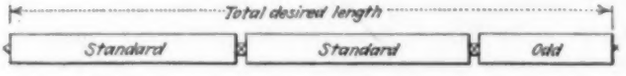


Fig. 5—Unit conveyor lengths

of length should always be calculated and the elements of diameter, pitch, material handled, capacity, of driving unit and shaft, and the gross weight of the conveyor should be taken into consideration.

The sectional flight conveyor is the best known form of screw conveyor and, with the exception of some few early examples of cast spirals, has probably been the variety used longest. There are a number of companies now producing this type commercially and several of the largest users maintain and operate their own production organization for the supplying of their own needs.

The sectional flight conveyor consists essentially of a spiral of sheet metal, approximately a helical section, fitted about the central shaft or backbone to which it it attached. Since the basis of the design is the pulling out of the ends of a split circle until the center pole fits snugly about the central core, the running length of each piece must, of necessity, be limited and it requires the joining together of several pieces along

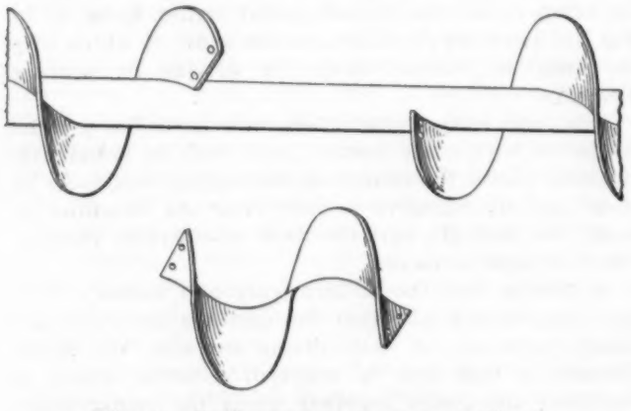


Fig. 6—Replacement of worn sections

the shaft or pipe in order to achieve any considerable length. This is the reason for its name "sectional conveyor."

The advantages of this type, as claimed by its users, lie in the fact that it is easy to replace worn units, as in Fig. 6, with new portions without disturbing the mounting of the conveyor in the trough or bearings. This advantage is unquestionably an important one in such cases as those where a certain section is directly beneath the discharge opening of another conveyor. Against this advantage is arrayed the disadvantage of having overlapping joints which will introduce a certain amount of interference to the travel of the material across the flight surface, and when it is considered that the conveying action in any form of spiral conveyor is one of continual "rubbing" or sliding, it can be appreciated that this can be no small argument.

The constant friction of the transported material across the conveyor surface, as in Fig. 7, obviously, has considerable wearing action upon the riveted fastenings between the ends of the flight sections, which not infrequently have become loosened and wrecked the joint in service. In Fig. 7, *A* represents a lap joint with a countersunk rivet, while an ordinary rose or round-head rivet is used in *B*. *C* and *D* represent butt-strap joints with one side riveted and the other welded. The shaded portions show the amount of wear necessary to loosen the joints. The arrangement of the overlap in such a manner that the slip of the conveyed material is over instead of against the joint lap, and

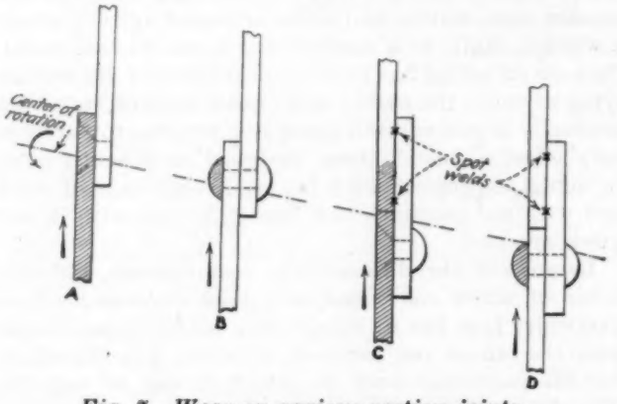


Fig. 7—Wear on various section joints

the use of countersunk fastenings are partial and sometimes complete remedies for these complaints.

A patent has been obtained within the last year for a type of conveyor that possesses the advantages of sectional repairs and replacements, Fig. 8, at the same time presenting a smooth surface to the travel of the conveyed material.

This form of flight lends itself to a lot of special sizes which demand equipment, costs of which would be prohibitive in the continuous type. The general idea in the manufacture of sectional flight conveyors is merely the stretching of a properly proportioned ring or circle of sheet metal into the shape of a rough helix. The makers of screw conveyors are almost daily called upon to make or figure upon jobs that are at best nothing but weird "freaks." One company, the author has in mind, takes pride in its willingness to undertake anything in the screw conveyor line, but the element of uncertainty exists so strongly in the handling of these special designs that this attitude can only be safely figured as advertising rather than as profitable business.

However, on any sizes or designs within a reasonably broad range, it is possible to estimate costs in a fairly satisfactory manner and the operations are all divided into the following brief classification: (1) Making the

circle; (2) forming the flight. This division purposely ignores the manufacture of the backbone or central core of pipe or shaft, since this manufacture constitutes a distinct series of operations, and, like the assembly operations, will be considered separately at a later point.

Item (1) of the above classification can be further subdivided as follows:

(a) Determining the size or dimensions
(b) Cutting outside
(c) Cutting inside
(d) Punching rivet holes
(e) Notching, where necessary
(f) Splitting.

Taking up these steps in the order shown above, and illustrated in Fig. 9, the first essential to the production of a satisfactory sectional conveyor flight is the proper proportioning of the material.

While it is possible for a skilled mechanic, acquainted with this class of work, to produce almost any effect by means of proper manipulation, and while some very poor products have been made to conform to very strict requirements through careful manipulation by hand, at the same time this method is never economical and for the most part is wholly unnecessary.

The temptation is strong in some cases to follow this crude plan and to "make the job on the bench" inasmuch as there do exist certain variables such as stretch, texture and formability in the material used, which make the best of figured dimension inaccurate at times, but in the greater number of cases it is possible to predict absolutely what results will be obtained with the facilities which it is proposed to utilize.

Assuming that the ideal flight is to be a perfect helix, the simplest rule followed, although not always

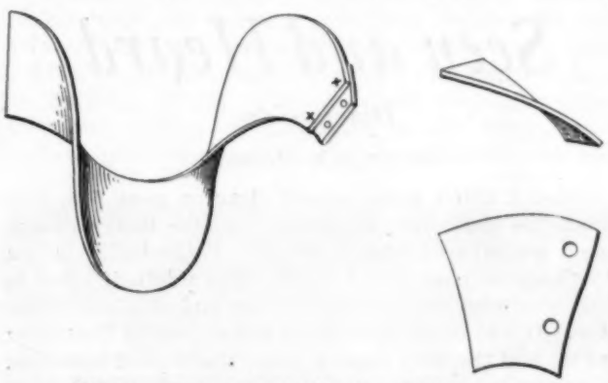


Fig. 8—Butt strap joint for flight sections

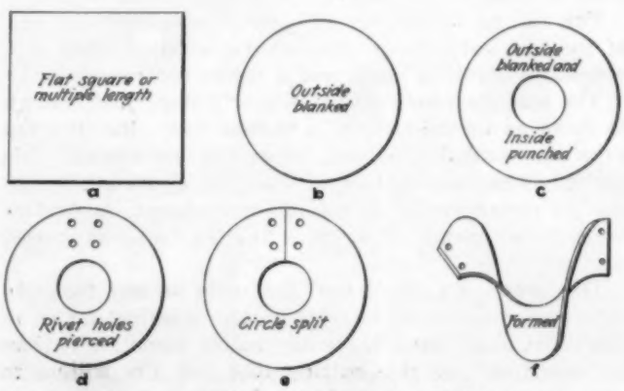


Fig. 9—Operations for forming a flight section

the best, is merely to get the periphery of the inside hole of the desired flight circle by determining the length of the spiral which, wrapped around the central pipe or backbone, would reach the required distance along the axis of the core, and give the required pitch. We obtain the outside diameter of the circle necessary to produce the approximate finished flight desired by

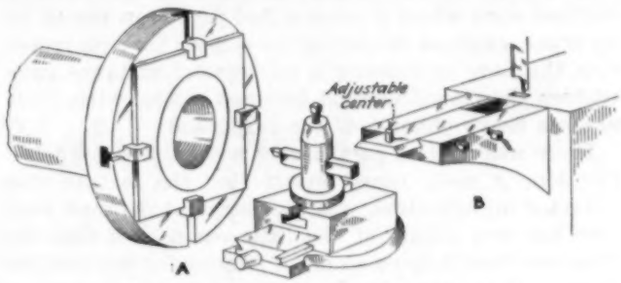


Fig. 10—Methods of cutting circles

using this periphery to determine the diameter of this center hole and adding to it the difference between the outside diameter of the finished conveyor and that of the central core or backbone.

The word "approximate" is used in the paragraph above, because a variable is introduced with changes in methods of forming, temperature of forming, texture of metal, thickness of metal and the relationship between the inside and outside helices of the desired flight section. The method described is substantially accurate and satisfactory in most cases, but it must sometimes be checked and modified by test observations to secure uniformity.

When the desired size of the circle has been determined, the producing of this circle is accomplished in a number of different ways. The choice must be influenced by the number of pieces to be made at any one time and it must be guided by the relative economy of each method as to total cost, set up, direct labor and the handling costs. It is well to remember at this point that, as far as possible, all conveying equipment should be made to correspond and conform to the "stock" types of the various suppliers.

It is rarely the case, when a design which a manufacturer has worked out and equipped himself to produce efficiently wont produce identically the same result as a similar design involving only slight variations in dimension or in contour. But those variations may be slight enough and yet sufficient to throw out all or most of the efficient production methods of the manufacturer.

If the customer's specifications conform to the maker's standards, the desired flight circle or blank could probably be made by means of a punch and a die and in the case of most makers of this sort of equipment, the material and circles would be found, probably, in stock for use in case of emergencies.

When there is neither the die equipment to make the sizes of light circles needed, nor the requisite amount of "stock" parts, the circles may be cut by means of either one of two methods, both illustrated in Fig. 10. At *A* is shown the lathe method for cutting the circle and at *B* is shown the nibbler method which requires a circling punch. For small runs the lathe method is more economical, since the intermediate rehandling necessary in a circle punch is obviated.

(To be continued)

Lining Up Work by Sound

By Robert B. White

WHILE I was passing through a large shop where heavy machinery is built, and where noise, bustle and apparent confusion seemed to reign continually, I noticed a workman standing on the base of a massive machine upon which a column had just been placed by the crane, engaged in testing the column for squareness with the base by passing a micrometer distance gage between the planed vertical face and a steel wire, from which a heavy plumb-bob was suspended.

There was nothing particularly novel about this job—I've done it many times myself—but the feature that attracted my attention, was the fact that the man wore over his ears a pair of the little ear-phones that the radio has been helping to make famous for the last few years. Here, thought I, is an example of what a thoughtful employer can do to keep his men contented; he lets 'em listen to the radio while they work. Going over to the man I asked him if he wouldn't let me in on the program. I wanted to listen to the music, too.

"Sure," said the man, politely, as he handed over the 'phones. "Listen all you want to."

Tuning In

I adjusted the ear-phones in the most approved manner and prepared to enjoy the music, while the man continued his work, methodically pushing the gage back and forth between the wire and the planed face of the column. The gage was made like an ordinary surface gage except that it had a micrometer thimble to adjust the pointer.

There didn't seem to be any music at first. "The darned old grouch has cut me off," I growled to myself. But just then there was a crash in my ears as if a bolt of lightning had landed in the middle of the shop. Gee! but this static is something awful, I reflected.

"How do you like that tune?" inquired my friend.

Tracing out the wire connections with my eye, I saw that one wire from the 'phones was connected to the plumb-line while the other, through a couple of cells of dry battery, was connected to the base of the machine.

The steel plumb-line was suspended from a stick of dry wood that was clamped to the top of the column, and therefore was insulated from it electrically, and hung parallel to the planed face at a distance of five or six inches from it. With the base of the distance gage held against the face of the casting, every time the feeler touched the wire the electric circuit was established through the 'phones, and there would be a crash of "static."

"I can surely detect a difference of one-half thousandth in the alignment of the wire by the difference of the intensity of the sound in the 'phones," said my friend; "and I believe I can 'hear' a tenth. You see, with all of this confusion and noise going on around here, lining the wire by the sense of sight or touch is some job. With the 'phones over your ears you have a kind of detached feeling, as if you were off somewhere by yourself, and that crash in your ears is a surer guide than either sight or touch can be."

After a few minutes' experiment with the micrometer adjustment of the gage, still keeping the 'phones on my ears, I was quite ready to agree with him. "Ever use it for anything else?" I asked.

"We lined up this crankshaft with it," said he. Here he put his foot on an adjacent crank and gave it a shove, causing the shaft to turn a few degrees in its bearings. That crankshaft, as I could easily see, was over 40 ft. long and had seven throws. Also, I had just been told, it weighed 39 tons.

"How did you get the measurements from the bearings to the wire?" I inquired.

"Had the micrometer thimble set into a base the under face of which had been ground to the radius of the bearings. The wire was run through the theoretical centerline, and with this gage we could feel for it from any part of any bearing, making due allowance, of course, for the sag of the wire as we approached the middle bearings. With the diameter of the wire and its length between points of suspension known, as well as the amount of tension under which it was strained, it's only a matter of looking in the handbook to find the sag, and the allowance is made by turning back the micrometer thimble."

This may be old stuff to readers of the *American Machinist*, but I had never seen it before, and I am passing it along in case there are others equally ignorant. The cost of the outfit is inconsiderable and the method of its application so absurdly simple as to need no explanation; while I am prepared to testify that in the matter of sensitiveness it is far beyond the sense of "feel" of anyone with whom I ever worked.

The feeling of being shut off from one's surroundings by having the ears muffled by the 'phones is by no means an imaginary advantage, as any one who has "run a line" by the wire method amid noisy and distracting surroundings need not be told.

Seen and Heard

Discussion

By John R. Godfrey

Either I didn't make myself clear on page 575, Vol. 63, of the *American Machinist*, or else Harry Senior didn't get what I meant about a "side tool," in his come back on page 394, Vol. 64. The side tool I had in mind was what we used to face the end of a bar in the lathe. It had to be thin to get down close to the center and we had the very reprehensible practice of loosening up on the tail center and letting the work "ride," so as to let the tool cut clear into the center hole and not leave a ridge to be removed afterwards with a file.

For taking a hogging cut, we abbreviated the end of the tool but left its other characteristics—that is a comparatively thin blade and a heavy top rake.

The side clearance was only 2 or 3 deg., just enough to clear as in the case of a thread tool. But the top rake was probably 60 deg. from the horizontal. The tool came as near cutting or shearing as we are apt to find in metal work. It was a shearing cut, instead of tearing the metal off as with the Taylor round-nosed tool.

Of course, it's the "edge" that cuts on any tool. In this case the cutting edge is on the side instead of in the front and I don't know any better name for it than a "side tool," or side cutting tool, but I'm willing to consider any name that Harry Senior may propose.

Automotive Production

Tooling for a Valve Guide

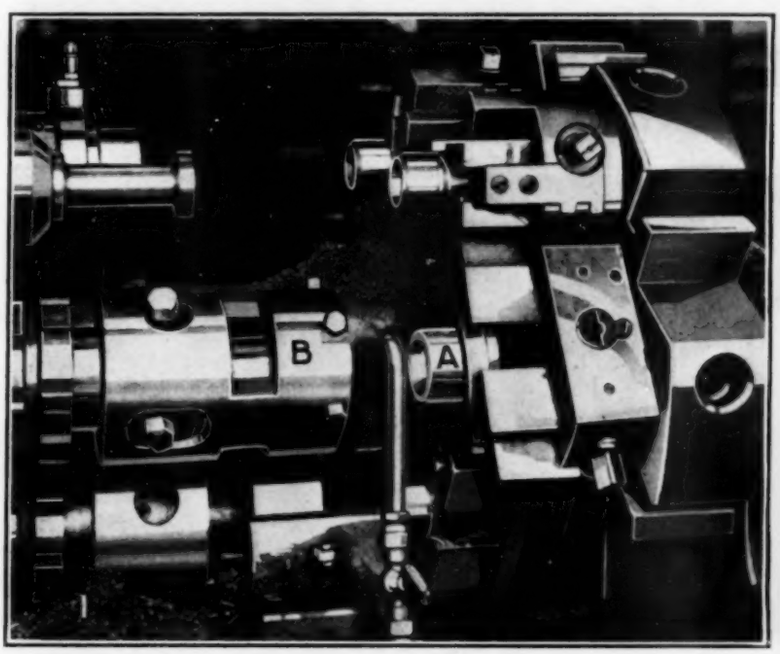
By Fred H. Colvin
Editor, *American Machinist*

Fixtures and methods for an unusual design of valve guide used in the new Stutz engine—Automatic turning and grinding machines used

THE overhead camshaft of the new Stutz engine requires a special type of valve guide. The guides are of cast iron and have two-lobed flanges by which they are attached to the cylinder head. First the guides are annealed, then snagged and the flanges rough ground for easy chucking in the New Britain machine shown in Fig. 1. The illustration shows the rough casting at *A* ready for the first cut by the tool *B*. In this operation, the guide is rough turned to 1⅞ in. diameter, rough faced and bored on the inside, and the flange faced, leaving from 0.009 to 0.011 in. of stock for finishing. In the next operation, the reverse side is faced and a pilot rough turned, leaving from 0.006 to 0.008 in. for finishing. The next operations include the finishing of the under face and pilot in a Cisco lathe, the drilling of two holes in the flange on a Gardam, multiple-spindle machine, and chamfering and milling a flat on one side on a U. S. hand milling machine, to allow nesting closely in assembly. The necessity for this flattening can be seen by referring to Fig. 4, where the valve guides are shown in position.

A clearance space is also milled on the side, as in Fig. 2, on the same type of machine. This operation requires two cuts, moving the work sideways. The angle of the fixture allows the cut to be made without removing any more metal from the bearing than is absolutely necessary. Next, the guide hole is ground to size on a No. 72, Heald full-automatic, as in Fig. 3, which shows the piece in place and the automatic gaging head *A* in position. The machine grinds 60 pieces per hour to very close tolerances.

After washing and inspection, the guides go to stores on their way to final assembly as in Fig. 4. Here the guides have been bolted in place on the head, which is



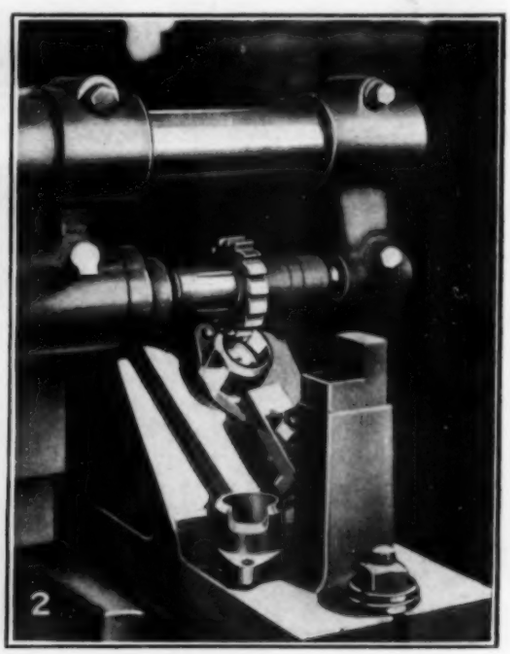


Fig. 1—Roughing on the automatic. Fig. 2—Milling side clearance

Automotive Production

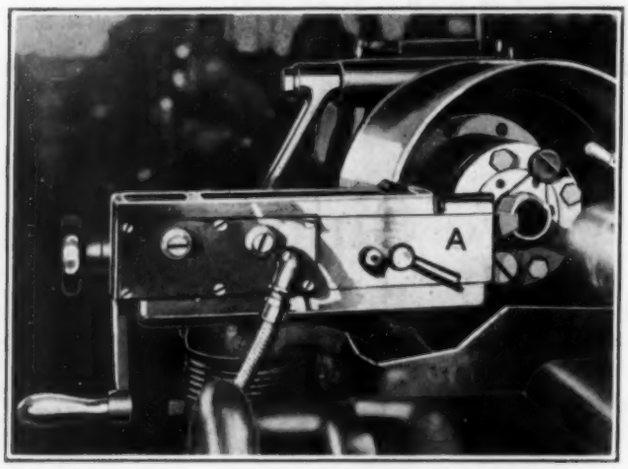


Fig. 3—Automatic grinding of hole

turned on its side to show them more clearly. The engine with the head in place is shown in Fig. 5. The five camshaft bearings can be seen in position as well as the camshaft over the valve guides. This illustration also shows the manifold pads and one set of spark-plug holes, which are duplicated on the other side.

The studs that hold the aluminum cover in place can be seen screwed into the top of the bearing in Fig. 5. In Fig. 6, both sides of the complete engine show the arrangement of manifolds, timer, generator, pump, etc. The intake manifold is shown in the engine at the right, and the two exhaust outlets in the one at the left.

These illustrations show the changes that have taken place in automobile design and how these changes affect manufacture. This type of valve guide, for example, presents a machining problem that is very different from that of the usual engine with an L-head cylinder block. It also changes the machining operations of the cylinder head in several ways.

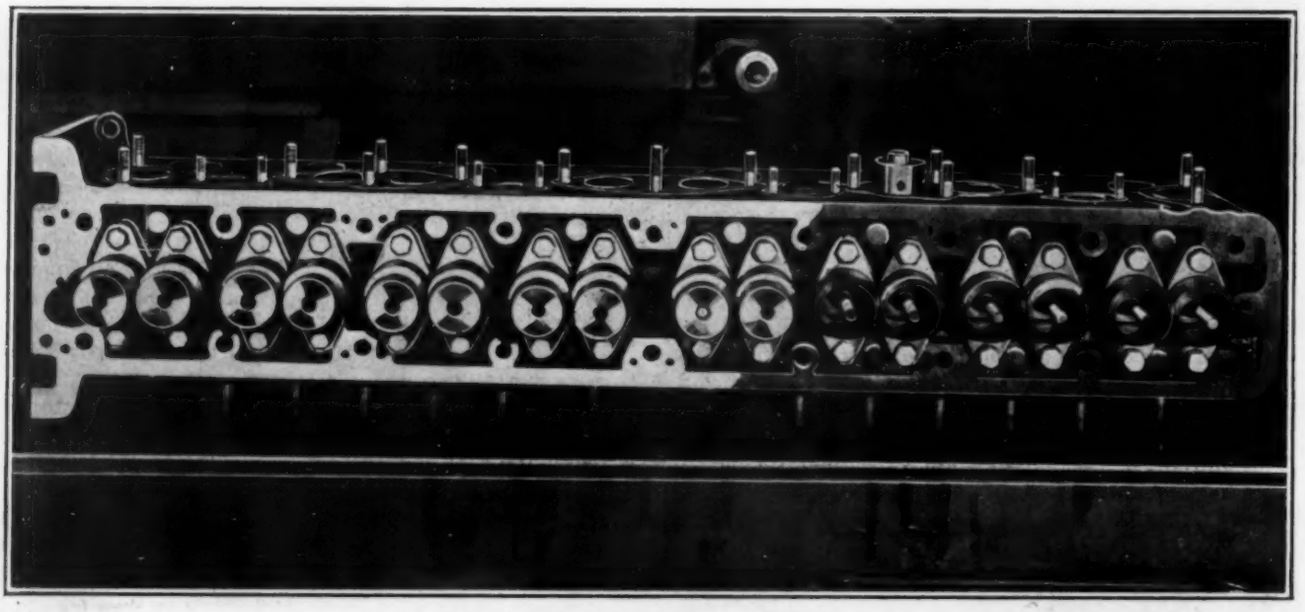
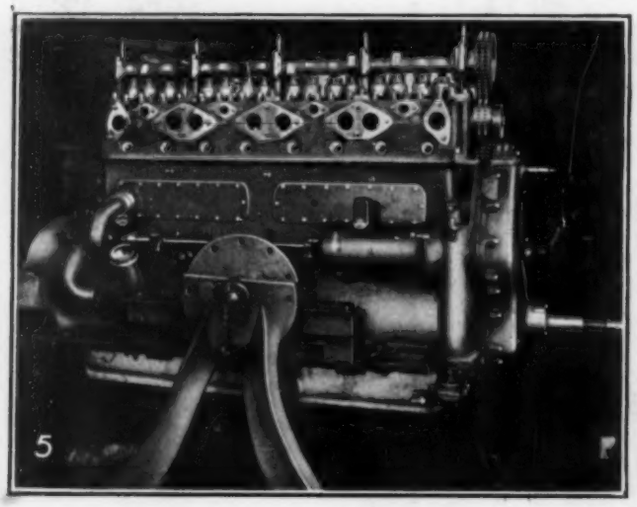


Fig. 4—Guides in place in head



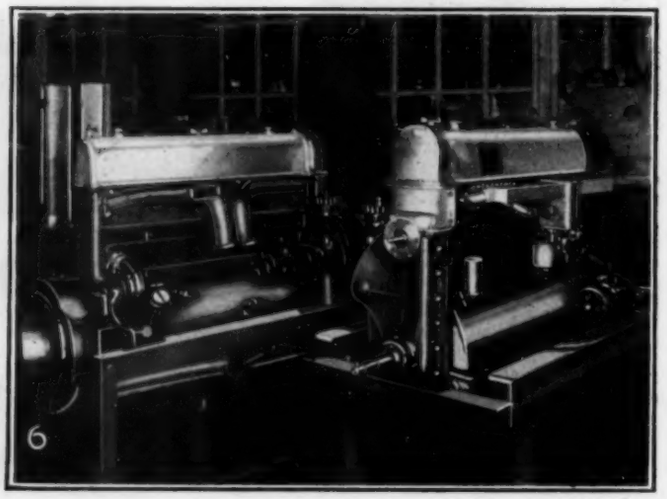


Fig. 5—Head camshaft and parts in place. Fig. 6—Two views of complete engine

Some Unusual Milling Operations on Sewing Machine Parts

By Henry Densmore

A Universal form-milling machine—Performs many operations formerly done by hand—An infinite variety of movements possible—Uniformity of results assured

MANY of the small parts of a sewing machine are of such peculiar shape that it would seem almost, if not quite, impossible to complete them by mechanical means. At the Bridgeport plant of the Singer Manufacturing Co., one of the pioneer builders of sewing machines, such parts were largely the product of hand labor until the engineers of the company designed and built the universal form-milling machine, the work of which is the subject of this article.

Intended at first to handle but a few of the more intricate shapes that were then in production, so well were the problems worked out and so completely were they covered by this machine, that there are now more than three hundred machines in service at the Bridgeport plant. There is scarcely an irregular shaped part of the general product, vastly more complicated now than when the machine was designed, that does not at some point in its progress through the shop, come from one or other of these machines.

The piece to be milled is carried at the end of the work-spindle of the machine by some form of holder or fixture made especially to suit the shape of the part and the nature of the cut to be made upon it. The work-spindle may be considered the main spindle of the machine, since it has no movement other than a rotative one, and no adjustments except those necessary to compensate for wear. Its axis is horizontal.

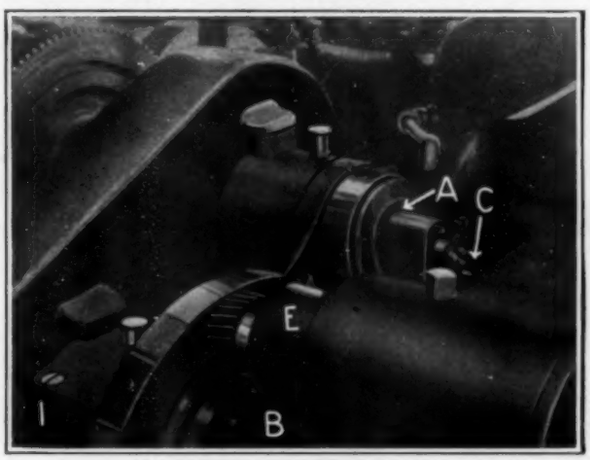
The rotative movement is derived through a train of change gearing from the drive shaft, and may be comparatively fast or very slow, according to the size and nature of the work. The spindle is hollow, to accommodate pieces that have a shank, and has an enlarged shoulder at the end to which the work-carrying fixtures can be attached by means of screws and dowels. The position of the work-spindle is indicated by the letter *A* in all illustrations herewith that show the machine.

Lying parallel to the work-spindle, and in a fixed position with relation to it, is a second spindle, indicated by the letter *B*, to which is attached the former that determines the shape to be milled. This spindle is provided with a large faceplate to which the former can be bolted, and is driven in 1:1 ratio with the work-spindle, through the same train of gears and from the same shaft.

Both spindles are driven by worm and wormwheel during the cycle movement of the machine, but when the clutch is disengaged, both may be turned together (but not separately) by hand. On many operations the spindles do not make a full revolution, but are cranked back to starting position while the work is being removed and the fixtures reloaded.

Parallel with, and opposed to, the work-spindle is the cutter spindle *C*, which is carried by a movable arm that swings about a stationary bar in the head of the machine. This part of the machine may be likened to the overarm and center support of a standard milling machine, except that the bar is at one side instead of above the work-spindle, and the swinging arm has no endwise movement upon the bar.

The bearings of the cutter spindle, however, are mounted in a sleeve, on the outer surface of which a thread of large, square section and coarse pitch is cut.



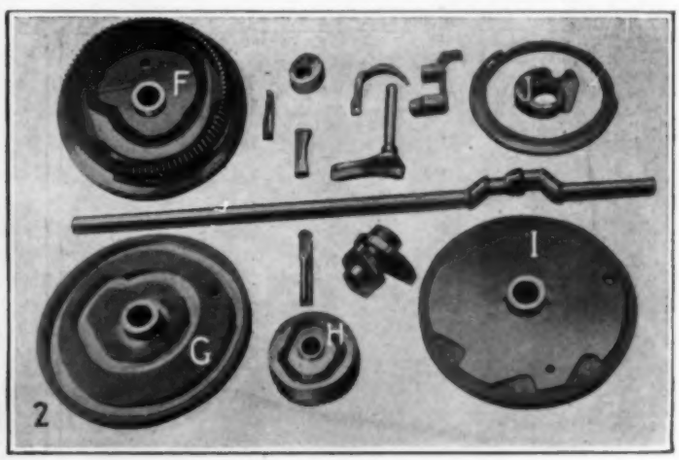
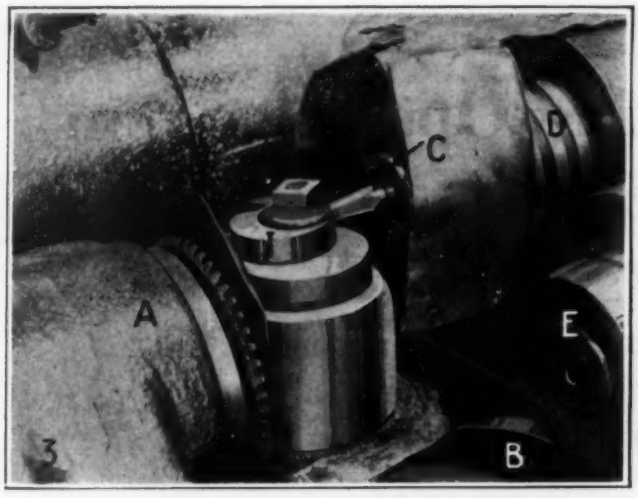


Fig. 1—Finish-milling a former. Fig. 2—Examples of work from the machine



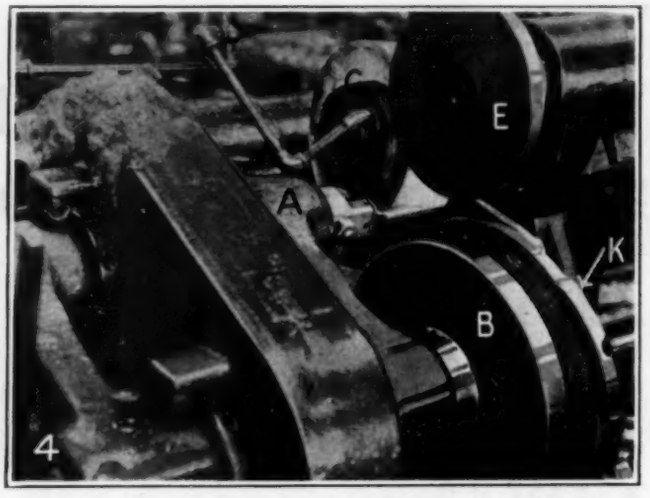


Fig. 3—Milling a helical groove. Fig. 4—Milling throws of crankshaft

The threaded sleeve, which may be seen at *D*, is screwed into a correspondingly threaded hole in the swinging arm and the thread is for the purpose of making endwise adjustment of the cutter. A clamping screw in the arm secures the sleeve in position after a setting has been made. The cutter spindle is gear driven.

At the end of the swinging arm and parallel with the cutter spindle, is another spindle, *E*—which may or may not rotate, as may be desired—to carry a roller that bears upon the former before mentioned. As the former is rotated in unison with the work spindle, the swinging arm is caused to rise and fall in accordance with the shape of the former; which is in effect a cam. It will be seen, therefore, that any shape of former will reproduce itself on the piece attached to the work spindle, but in reduced proportion as the radius of the arc through which the cutter moves is to the radius of arc described by the roller, and providing also that the roller and cutter are of the same diameter.

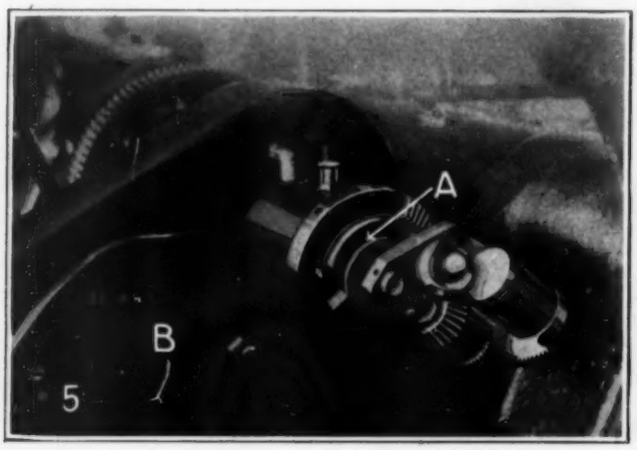
The full scope of the machine as originally designed, was to reproduce a given shape of former that could be laid out and cut in the toolroom in accordance with the dimensions of the piece as given on the drawing, and with due regard for the increase in proportion.

It was soon discovered, however, that by varying the relation between the roller and the cutter; by changing the ratio of rotation between the work spindle and the former; and—more than by any other means—by the use of special fixtures having a rotative movement of their own in a plane at an angle to the axis of the work spindle, an infinite variety of shapes could be produced by the machine.

One may readily conceive that to plot a former to produce a given shape of work-piece through the reduction of proportion and the modification brought about by the combination of these various movements, would be a well-nigh hopeless job. Fortunately the principle upon which the machine is constructed renders calculation unnecessary.

If a sample of the work-piece it is desired to reproduce, is attached to the work spindle or the fixture, as the case may be, a plug or disk of the same shape and size as the cutter to be used is fixed in the cutter spindle; a revolving cutter of the same diameter as the roller to be used is substituted for the roller; and a plain, round disk of cast iron is attached to the faceplate that is to hold the former; the machine has but to be set in motion and allowed to run long enough, when it will itself produce the cam, or former, that will in turn duplicate the work-piece or sample when the conditions are again reversed; and this without one line or figure or calculation.

While the method of procedure above outlined is possible it would require an unwarrantably long time to accomplish. The men who have in charge the making of formers for new work have become so familiar with the machine and its possibilities, that they can lay out and cut, by toolroom methods, a former that is reason-



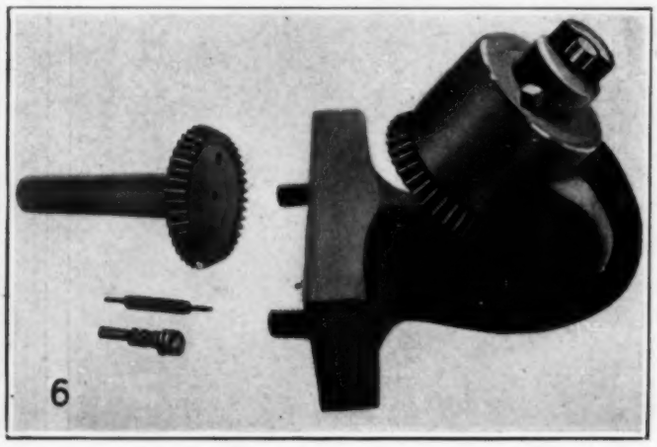


Fig. 5—Work rotating in two planes. Fig. 6—Stationary type of fixture

ably close to the necessary shape. The machine is then set up as here described and the cutter has only to make a light finishing cut, once over the active periphery of the former, to correct any minor error that may exist in the layout.

In Fig. 1, the machine is shown in the toolroom as set up for this job. The only features of this toolroom machine that are not to be found on the machines in the shop are: the cutter and cutter spindle in place of the roller; a set of idler pulleys and a runaround belt to convey power to the cutter; and a counterweight applied to the swinging arm to relieve the cutter of excessive weight.

Some of the pieces milled on the machine are shown in Fig. 2. Most of them are examples of plain, peripheral milling in which only the regular unmodified movements of the machine are employed; as at *F*, *G*, *H*, and *I*, upon which the operations are to mill the cam-grooves and contours. At *J* is a part requiring a movement in two planes.

The body of the fixture is in this case bolted to the head of the machine and has no movement. The small, vertically-disposed spindle to which the work-piece is fastened is rotated by a miter gear meshing with a corresponding gear that is bolted to the shoulder of the work-spindle, where it may be seen in the illustration. At the same time that the work-piece is revolving about its vertical axis, the cutter, under the influence of the former and its roller, is swinging in a vertical plane. The path of the cutter with relation to the work is helical, but in this operation the helix makes but part of a turn around the axis of the work.

The throws of the crankshaft shown in Fig. 2 are milled, and it is upon this job that the machine shown in. Fig. 4 is engaged. The fixture holds the shaft by one of the throws, the long end of the shaft extending into the central hole of the work-spindle. The cycle of the machine includes lowering the cutter to position, milling completely around the circumference of the throw, and lifting the cutter to clear the work. The machine then goes out of action, and at the same time rings a bell to call the attention of the operator, who probably has from three to five other machines to attend.

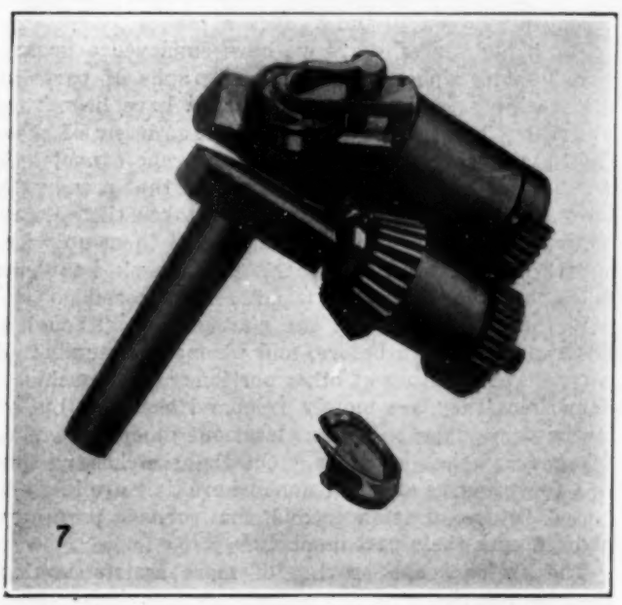


Fig. 7—This fixture displaces several hand operations

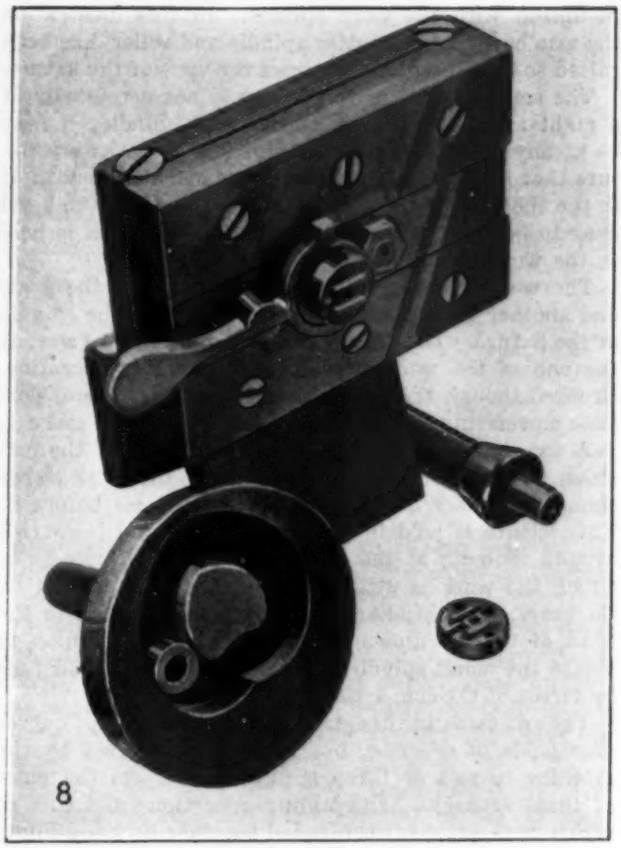


Fig. 8—Fixture to mill dovetail slot

The holding fixture in this case does not center the throw, but leaves it offset about half its normal amount and the path of the cutter is therefore eccentric. Arbitrary conditions make this advisable, and it is just as easy to make a former to cut the eccentric path as to make a circular one.

On this job it is necessary for the work-spindle to make more than a full turn to each cycle, to allow time for the run-in and run-out of the cutter, and this is made possible by a swinging latch on the former. The illustration shows the machine at the completion of the cycle, with the roller, *E*, resting upon the latch. Upon unloading the fixture the operator will lift the arm, turn over the latch—which is hinged at the end opposite to where the roller now rests—crank the spindles backward about a quarter of a turn and lower the roller again to rest upon the latch, ready to run down upon the periphery of the former as the machine is started and the cutter swings into its cut. Part *K*, shown in this illustration, is a stationary wiper that bears upon the periphery of the former to keep it clear of chips and dirt.

In Fig. 5, the machine is shown set up for one of the most complicated operations it is called upon to perform; one in which three separate motions are combined. The fixture is carried by the work-spindle and swings with it through part of a revolution about the horizontal axis. At the same time the small spindle upon which the work-piece is mounted, is rotating about its own axis at a right angle to the axis of the work-spindle, driven by a train of gearing from the stationary bevel-gear segment that is bolted to the head of the machine. Further, the cutter is swinging in a vertical plane, actuated by the former *B* as it rotates

in unison with the work spindle. In this illustration the arm carrying the cutter spindle and roller, has been raised so that it will not obstruct the view of the fixture.

The small spindle of the fixture is not necessarily at a right angle to the axis of the work-spindle; it may be at any desired angle. In Fig. 6 is a stationary fixture that is bolted to the head of the machine instead of to the shoulder of the spindle, and actuated by the bevel gear to be seen at the left, the shank of which is held in the work-spindle.

The work and the cutter are shown below the gear, and another work-piece is shown in place in the spindle of the fixture. The "corkscrew" cut that may be seen at the end of the work-piece is milled in this operation. Crooked though this cut is, but two of the several possible movements of the machine are combined to make it.

A fixture that combines three movements of the machine is shown in Fig. 7, with one of the work-pieces clamped in place and another upon the table before it. This fixture is held in the work-spindle and is carried around with it; at the same time the small spindle to which the work is attached at an angle, is rotated by its gears. A stationary gear-segment attached to the head of the machine meshes with the bevel pinion to rotate the small spindle, and the cutter rises and falls by virtue of the cam action of the former.

The cut made at this stage is a combination of curves impossible to describe, but which is completed by the machine in two or three minutes. It takes the place of three separate, hand-milling operations, the cuts of which were afterwards blended together by hand filing. No filing or other hand work is now necessary, and the pieces are uniform as they come from the machine.

Still another type of fixture is shown in Fig. 8. The body of this fixture is bolted to the head of the machine and remains stationary, while the slide to which the work is attached moves forward and back, once to each revolution of the work spindle. The face cam shown to the left of the fixture is the actuating medium, and is held by its shank in the work-spindle. The roller to be seen in the cam groove fits over a stud on the back of the slide. The cutter, shown to the right, is held by a spring collet in the cutter spindle. The cut is the wide, dovetailed slot across the face of the piece.

The duty of the former in this case is to lower the cutter to the position necessary to make the bevel cut along the lower side of the slot, hold it steady during the cut, and then to raise it high enough to allow it to make the cut along the upper side of the slot, as the slide of the fixture returns to starting position.

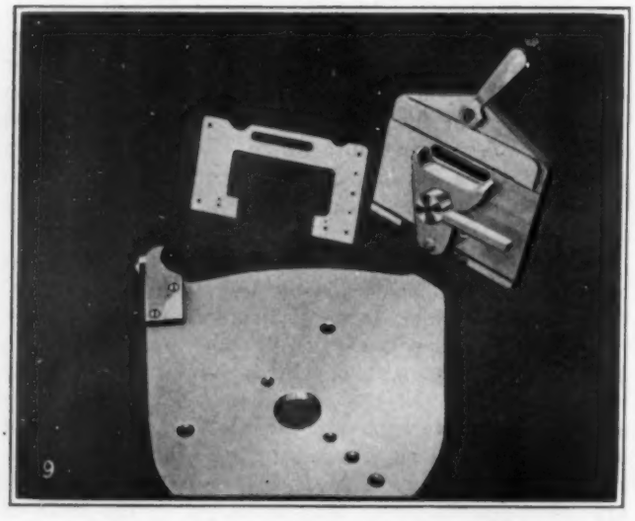


Fig. 9—Milling a straight slot in a rotating piece

Not a little of the work that comes to these machines *might* be done in standard profiling machines, but, though the company has a battery of such machines in constant service, these jobs continue to be handled by the milling machines for the following reasons: The "human element" enters into the product of the profiler. Two workmen may produce quite different results on the same machine and set-up. One workman, at different times in the same day, may produce quite different results, still with the same machine and set-up. The operator of the milling machine, on the other hand, has nothing whatever to do with the product of his machine; he merely loads the fixture and starts the cycle. The result is uniform pieces.

An example of this type is shown in Fig. 9, together with the holding fixture and the former. The job is that of profiling the narrow, rounded-end slot in the plate. The fixture is bolted to the shoulder of the work-spindle and revolves with it. The astonishing feature of the job is that, though the slot is perfectly straight, the work rotates through a half-revolution during the cut. The hook on the former is to prevent the operator from accidentally turning the spindles forward by hand after the cut is completed, an action that would promptly smash the small profiling cutter.

Photographs for Drafting Records—Discussion

By A. F. Guyler
Notts, England

While the article by John F. Hardecker under the title given above, on page 383, Vol. 64, of the *American Machinist*, is interesting, I venture to say that unless Jack Smith's trouble differs greatly from ours, Bill's cure will not entirely end it.

Our product consists of machines, which although made up of parts common to most of the machines we make, differ in most cases in the assembling of the parts. The machines have 6,000 or more parts and vary in length between 10 and 36 feet.

For a number of years we have employed a professional photographer to make photographs of parts of the machines, and these photographs have been very useful, but our trouble has been that so many of them have their usefulness reduced because one cannot look around, or through, some of the parts that occupy the foreground. In some cases we have taken the various sections out of the machine and rigged them up without the framework, while the photograph has been taken, but this procedure is not always possible.

We still continue with the photographs, although a lesser number than before, and we make a number of perspective drawings of other portions of the machines. Sometimes they are merely freehand sketches, but in ink on thin paper, so that at least one blueprint can be taken from each of them. On the sketches we put in a few remarks or dimensions where they are likely to be of future assistance, and the various parts are marked with their part numbers.

The sketches are proving of more assistance than the photographs.

Welding and Air Equipment in the Danville Shops

By Frank W. Curtis
Western Editor, *American Machinist*

Welding of locomotive units—Both electric and oxyacetylene equipment used—Labor saving tools operated by air—Home-made press for brasses

AN EXAMINATION of the repair work being done at the Danville shops of the Chicago & Eastern Illinois Ry. Co., will convince one that neither autogenous welding nor the universal use of air-operated tools have been overlooked.

Twenty men are employed for electric and gas welding, each one specializing in some particular class of repair. The entire welding unit is under control of a foreman who is responsible for the work, whether it is handled in the welding department or at the pits. Parts that can be stripped from the engine are transported to the department, located at one end of the back shop, where an inspection is made to determine how they are to be handled. If the work is such that it cannot be taken to the department, the foreman makes a personal inspection of it and then gives his instructions to a welder best suited for the job.

Oxyacetylene gas is supplied by a generator through a manifold located in a shed next to the welding department. The gas is piped to several outlets in the department, and also along the side of the back shop next to the pits. Outlets are provided at each pit, so torches can be connected when required. Three electric-welding units and five oxyacetylene stands comprise the portable equipment used. The portable stands are used on work that is too heavy to be brought within reach of the pipe lines. A small furnace, located in the welding department, is used for preheating work up to the size of driving boxes. Miscellaneous stands, racks, guards, tables and supporting blocks, also used in connection with welding, are located in the department.

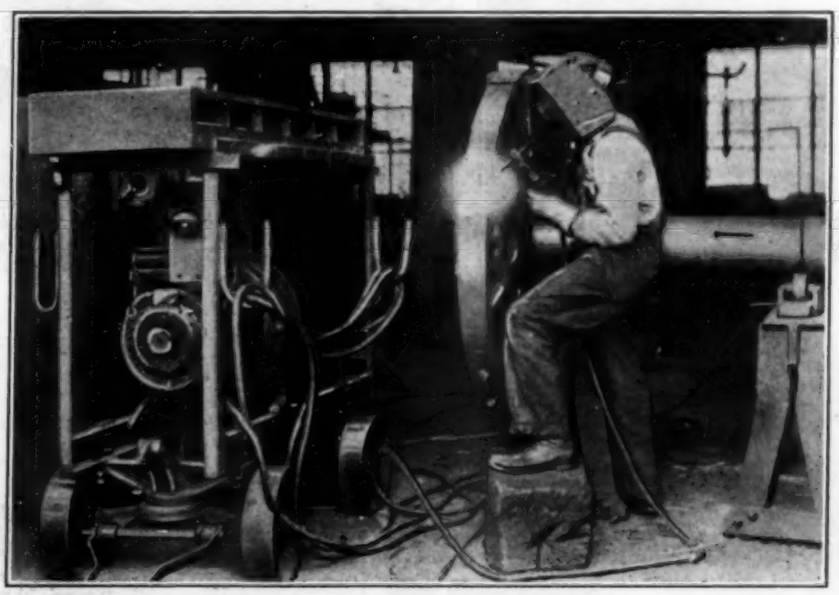


Fig. 1—Arc-welding the rim of a wheel center

One of the electric outfits in operation, a 220-volt d.c. arc welder, is illustrated in Fig. 1. Here the operator is building up the rim of a wheel center that requires the use of a special electrode. The axle on which the wheel centers are mounted, rests on two stands that are provided with rollers, so that it can be revolved easily. The welding sets are used also for fire-box repairs.

Worn pistons are built up as shown in Fig. 2. The work is placed on a stand and revolved by the operator as the welding progresses. The piston shown is 19½ in. in diameter and requires approximately 16 lb. of manganese-bronze rod to build up a ⅛-in. layer over the worn surface. The welded surface is then turned on the 36-in. lathe shown in Fig. 3. Two cuts are taken to complete the operation. Salvaging worn pistons by this method has been found satisfactory, from the standpoint of both service and economy.

After the piston has been fitted with rings, it is assembled to the crosshead, which in turn is machined on the babbitt-lined surfaces in the assembled condition, to insure proper alignment. Fig. 4 shows a piston and crosshead set up on a 36-in. planer. The piston rod rests in two V-blocks and is lined up with a square and a surface gage, after which it is clamped as shown. When one side of the crosshead has been completed the clamps are released and the work revolved 180 deg. In this way, the guide fits are machined accurately. The air-operated hoist, shown overhead, is used to load and

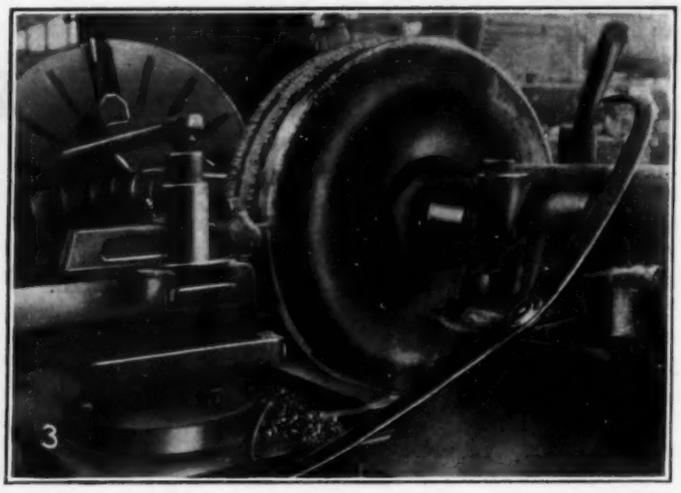
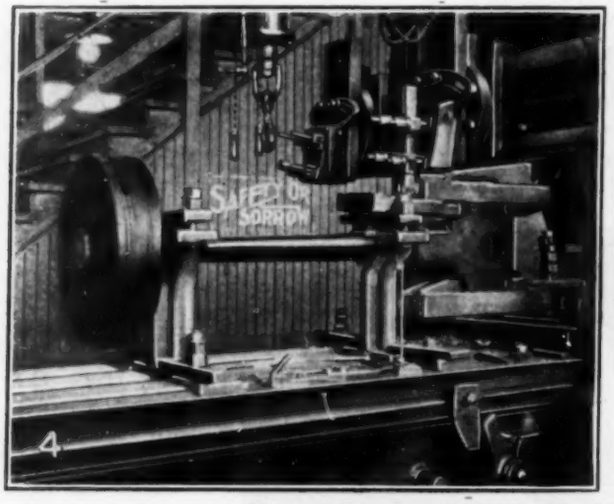


Fig. 2—Building up a worn piston. *Fig. 3—Turning a built-up piston*

unload the work. On the wall may be seen a sign "Safety or Sorrow—Watch Your Step." This motto is stencilled in many places throughout the shop as a safety-first slogan.

Air has been applied to the operation of many tools and machines, some of which are illustrated. The valve-setting device shown in Fig. 5, is operated by an air motor through worm gearing. Two knurled driving rolls are located at the end of the driving shaft, while on the idler shaft, shown at the rear, are two smooth-faced rolls. The center distance between the shafts can be adjusted to suit the diameter of the driving wheels, so they will rest on all four rolls. By the use of this device, the main driving wheels can readily be



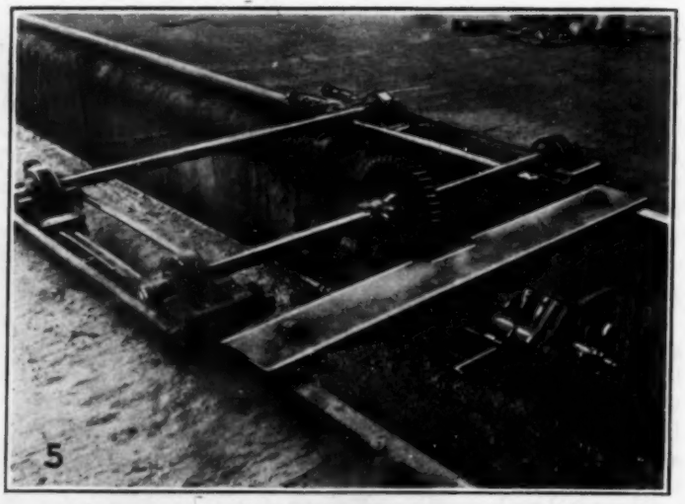
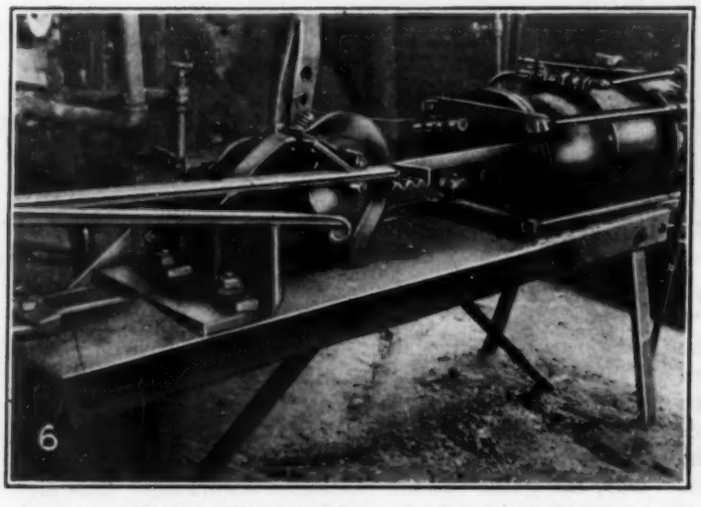


Fig. 4—Planing a crosshead. *Fig. 5—Air-operated, valve-setting device*



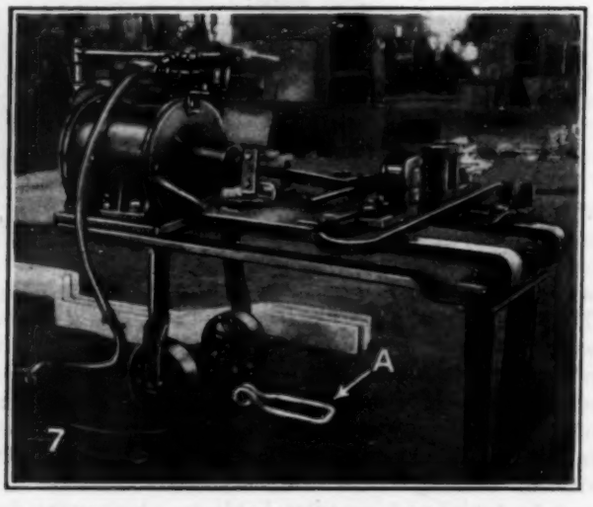


Fig. 6—Home-made eye-bending machine. *Fig. 7—Portable, air-operated bending machine*

revolved to bring them to the proper points for setting the valves.

There are several air-operated machines in the forge shop, among which is the home-made eye bender shown in Fig. 6. The base, made of 12-in. channel iron, has an air-brake cylinder located at one end, the bending dies being at the opposite end. The bending is accomplished by pins in a revolving disk, about one of which the material is wrapped. The disk is revolved by a rack and pinion as shown. The rack is part of an old jack. The work is heated to 1,350 deg. F. and placed in the machine between the pins, so that the end of the bar is brought against a bracket fastened to the air cylinder. The air valve is controlled by a treadle. A finished piece is shown in front of the piece about to be bent. Twelve different sizes of eyes are made in the machine, some of the smallest being formed two or three pieces at a time. Air pressure at 60 lb. is used.

Another air-operated machine, made from several obsolete parts, is shown in Fig. 7. The unit is portable, having a pair of truck wheels at one end and a supporting stand at the other end. An anvil to suit the work is fastened to the frame, while a corresponding plunger is attached to the ram. The work being formed, a brake-shoe hanger, is placed in the ram and forced through two rolls in the anvil. The eyes are formed on the machine previously illustrated. A finished part can be seen on the floor at *A*.

A home-made press for forcing crown brasses into driving boxes, is shown in Fig. 8. The driving box is brought to the press by an air hoist, and the brass is entered by hand. A coating of white lead is put on both parts and a steel driving plate is placed on the brass, which is then pressed in. The air cylinder is made from an obsolete cylinder bushing, 21 in. in diameter and is equipped with scrap cylinder heads at the ends. The ram of the press is 4 in. in diameter and is made from an old piston rod. Air at a pressure of 200 to 230 lb. is used to operate the press, and is supplied from the air-brake department. A three-way valve is used to operate the press. The crown brass shown is 11½ in. in diameter and the time required for pressing it into the driving box is very short, approximately from 20 to 30 seconds.

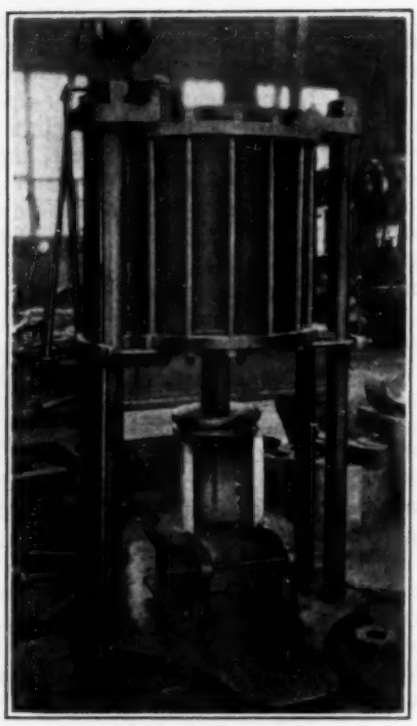


Fig. 8—Home-made press for seating crown brasses

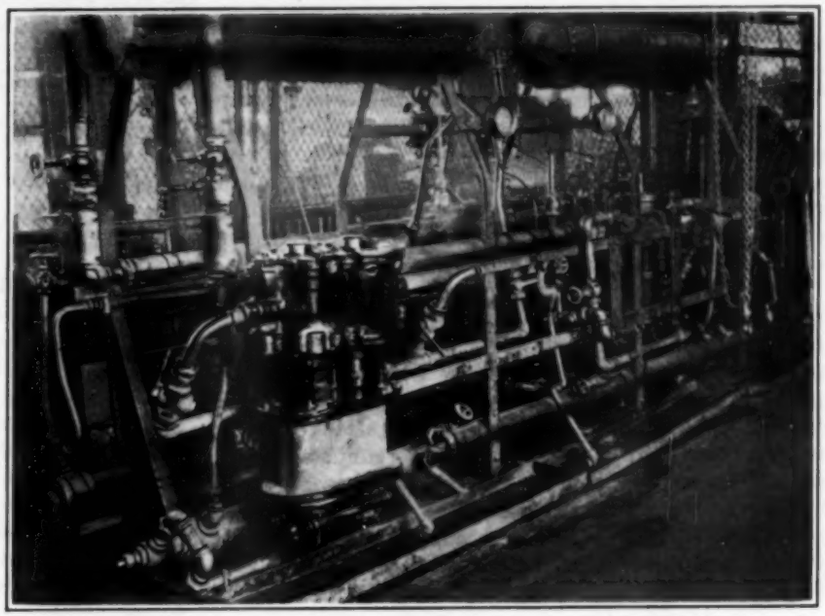


Fig. 9—Equipment for testing air-brake pumps

Air-brake pumps are tested on the stand shown in Fig. 9, which accommodates five units. The pumps are transported by chain hoists running on an overhead track. Lubricators also are tested on the same stand. At the far end can be seen the pump that furnishes the air pressure for the press described in the preceding illustration.

The importance of air-operated machines in the railroad shop is being given a great deal of attention on the part of shop executives.

Reason vs. Threats—Discussion

By J. Homewood

In reference to G. B. Stewart's appeal on page 700, Vol. 64, of the *American Machinist*, for greater consideration for employees when posting notices, it must be admitted that shop notices savor of the same traditional thoughtlessness as some of our time-worn business phrases such as "I beg to state," "Yours of the tenth at hand," and all of the other artificial bunk handed down from the great grandfathers of the past.

It must be borne in mind, that shop notices pertaining to vital interests of the employer are posted with a definite aim in view. Employees are of two kinds: those who are willing to go half way and are continually on the lookout for the interests of the employer, and those who have no interest whatever other than getting all that is coming to them. The management does not consider a notice as being a message to the whole force, when posted under such circumstances, but to that element of humanity that cannot be reached in any other way. The "square shooter" type of employee is, happily, in the great majority, and looks upon such notices as a message, not to him, but to the one whose medicine must be administered in such doses.

Recording Air-Pump Repairs

By George Feltner

AT THE Danville shops of the Chicago and Eastern Illinois Ry., a record of air-pump repairs is made of each unit that is reconditioned. A printed form, such as illustrated, is filled out by the foreman of the compressor department and filed for future reference. There is an available sheet for practically every pump now in use, which aids in checking the life of a unit between overhaulings and whether or not it is receiving proper care while in use. In the event of a breakdown at some far-off point, the repair records can be examined to see if the pump has been in use beyond a safe length of time.

When a locomotive is shopped for either minor or major repairs, the foreman obtains the number of the air pump and makes reference to the corresponding repair record, in order to determine whether or not the unit is in need of attention, or is in suitable condition for future use. Since air pumps are often changed from one engine to another at distant roundhouses, an additional record is kept in a small pocket-sized book, showing the pump number and the engine to which it is applied. If, for example, a recently-overhauled pump is changed to an engine in need of major repairs, the records will show that the pump is in working condition. Considerable time is saved in this way.

Another advantage, is the possibility of observing the wear on the working parts of the pump in accordance with its service. If a unit is returned for overhauling in a time less than is usually allowed, it is an indication that some part has broken down or become misaligned. A check of the records shows the condition when it was repaired, and the cause of failure can generally be determined. Wearing qualities of various parts made of different materials can be compared. One other advantage of the record, is the opportunity to keep a balanced supply of new material on hand for replacements. By going through the records, a check can be made of the pumps in use, their condition, and what parts will be needed for their reconditioning.

The air pump recorded on the form is a duplex-type pump of which the steam cylinders are of equal size. The high- and low-pressure tabulations are filled in accordingly.

Air-Pump Repair Record

Symbols "RB"—Rebored "TD"—Turned "AN"—Annealed "D & P"—Drilled and Pinned

Mark "X"—New Mark "O"—Repaired

Make	Size	Serial Number	Class Repairs	Date Repaired	Mechanics Name	Hours Labor	Time Charged
N.Y.	6	379	1	3/18	D.W. Sanders	14	Reg 371-B

Applied Engine No. 1900 - Back Shop - March 25 1926

Item or Part	Steam Cylinders — High Pressure	Steam Cylinders — Low Pressure	Air Cylinders — High Pressure	Air Cylinders — Low Pressure
Large diameter	7/0 R.B.	7 9/64 R.B.	7/0 R.B.	11 3/8 R.B.
Small diameter	7/0 R.B.	7 9/64 R.B.	7/0 R.B.	11 3/8 R.B.
Piston diameter	7 9/64 X	7 9/64 X	7 9/64 X	11 3/64 X
Piston rings	X T.D.	X T.D.	X T.D.	X
Piston rods	X 1 3/8	X 1 3/8		
Tappet plate	X	X		
Tappet-plate bolts	X	X		
Main steam head	X	O		
Steam-chest bushing	X 2 1/4	X 2 1/4		
Steam-chest cap	O	O		
Steam-chest gasket	O A.N.	O A.N.		
Steam valve	O 2 1/64	O 2 1/64		
Steam-valve rings	X	X		
Steam-valve stem	X D & P	X D & P		
Stuffing boxes	O	O	O	O all X
Main gaskets	X	O A.N.	O	O A.N.

	Valve	Seat	Cap
Upper air inlet	X	O	O
Lower air inlet	O	X	
Upper intermediate	X	O	O
Lower intermediate	O	X	
Upper discharge	X	O	O
Lower discharge	O	X	

Remarks: Steam and air cylinders removed and new ones applied

Foreman John P. Agan

Form on which Air-Pump Record is kept

The Changing Environment of Industry

By Magnus W. Alexander

Science tells us that man is the product of heredity and environment. In the same way, industry can be considered as subject to laws of heredity and environment. The more primitive men are, the more are they dependent on and limited by their environment. Only where highly developed economic organization exists do they gain a comparative freedom from it. Yet this comparative freedom is more apparent than real as can be recognized from the example afforded by the recent general strike in England.

Modern industry is a new experience in human civilization and one of the greatest experiments that civilization has ever tried. The growth of population has been one of the recent changes in industrial environment and with the damming of the immigrant tide we find an increased use of power. In 1869 the number of horsepower per wage earner was 1.14. Today it is about 4 horsepower.

Another significant change in the economic environment of industry is the marked development of large-scale production and corporately owned establishments. In 1904, 1.3 per cent of the manufacturing establishments in the United States were in a class whose value of product was $1,000,000 or over, and employed 26 per cent of the wage earners. They manufactured 38.5 per cent of our products. In 1923, the number was 5.3 per cent, employing 57.1 per cent of our labor and producing 66.4 per cent of our products. The outlook is for an increasing growth in this direction.

Agriculture has not held its own with population growth. While the physical volume of agriculture has risen 39 per cent between 1919 and 1924, manufacturing production has risen 162 per cent and mining 222 per cent. Industry cannot for long exist on a prosperous basis with agriculture in the position in which it finds itself. We must also notice the steady decline in the export of crude materials and a corresponding increase in the export of manufactured goods.

Industrial management has become a dominant influence in the operation of industry and has helped do away with class spirit by humanizing industry. The tendency for groups of employers and wage earners to force upon each other their own selfish viewpoints must be guarded against.

Abstract of an address delivered at the tenth anniversary meeting of the National Industrial Conference Board.

The Design of Gear Tooth Forms

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

The 20-deg. stub-tooth gear system is desirable for gears of a small number of teeth—Proportions of this system—Duration of contact

ANOTHER gear-tooth system, introduced to meet the need of effective gears of small tooth numbers, is the 20-deg. stub-tooth system. This system not only increased the pressure angle from the conventional 14½ deg., but also reduced the tooth height, thus employing different tooth proportions. Several different stub-tooth systems have been widely used, most of them with a pressure angle of 20 deg. but with slightly different tooth heights.

The following 20-deg. stub-tooth gear system has been adopted by the American Gear Manufacturers' Association and also by a sectional committee of the American Engineering Standards Committee as a tentative standard. This form will interchange with

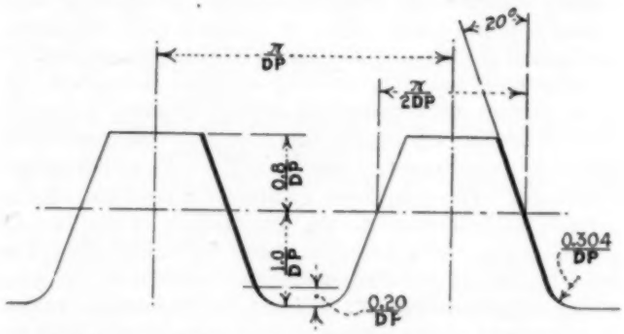


Fig. 59—Basic rack of the 20-deg. stub-tooth gear system

all the existing 20-deg. stub-tooth systems; the differences in tooth heights affect only the clearance. This tooth form has the following proportions:

When DP = diametral pitch
M = module

Addendum	$= 0.8/DP = 0.8M$
Dedendum	$= 1.0/DP = 1.0M$
Working depth	$= 1.6/DP = 1.6M$
Whole depth	$= 1.8/DP = 1.8M$
Clearance	$= 0.2/DP = 0.2M$

The form of the basic rack of this system is shown in Fig. 59.

When DP = diametral pitch
CP = circular pitch
N = number of teeth in gear.

$$\text{Outside diameter} = \frac{N + 1.6}{DP}$$

$$\text{Pitch diameter} = \frac{DP}{N}$$

$$\text{Root diameter} = \frac{N - 2.0}{DP}$$

$$\text{Circular pitch} = \frac{3.1416}{DP}$$

$$\text{Thickness of tooth on pitch line} = \frac{CP}{2} = \frac{1.5708}{DP}$$

An analysis similar to those of the two preceding gear systems will be made of this 20-deg. stub-tooth system. For the first example we will take the 12-tooth pinion of this system.

Let E = outside radius
R = pitch radius
a = radius of base circle
F = addendum of basic rack, including clearance fillet
f = clearance on generating rack or hob
A = minimum root radius without undercut
H = root radius
α = pressure angle
e = excess depth of root beyond undercut limit
x = radial height above base circle of undercut part of profile
Q = radius of top of undercut
N = number of teeth
Pn = normal pitch.

We have the following values for a 12-tooth pinion of 1 diametral pitch:

$E = 6.8000$ in.
$R = 6.0000$ in.
$H = 5.0000$ in.
$F = 1.0000$ in.
$f = 0.2000$ in.
$\alpha = 20°$

$a = R \cos \alpha = 5.6381$ in.
(Equation (55), eighth article)

$A = R \cos^2 \alpha - f = 5.0981$ in.
(Equation (60), eighth article)

$e = A - H = 0.0981$ in.

$x = \dfrac{1.5158\, e^2}{R} = 0.0024$ in.
(Equation (65), eighth article)

$Q = a + x = 5.6406$ in.

The shape of this pinion tooth is shown in Fig. 60.

Let us examine the contact conditions between this pinion and a rack. We have seen before that the con-

The fourteenth article. The fifteenth will appear in an early issue.

tact between a rack and an undercut pinion, in terms of tooth intervals, is equal to

$$\frac{\sqrt{E^2 - a^2} - \sqrt{Q^2 - a^2}}{Pn}$$

In this example, $\sqrt{E^2 - a^2} = 3.8014$ in.

$\sqrt{Q^2 - a^2} = 0.1682$ in.

$Pn = 2.9521$ in.

Whence contact with rack = 1.24 tooth intervals.

We will next determine the contact conditions when two 12-tooth pinions mesh together. In this example,

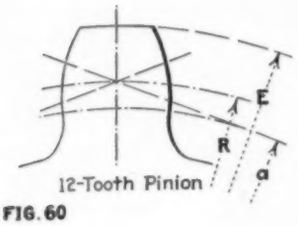


FIG. 60

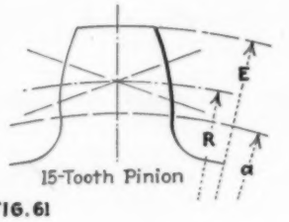


FIG. 61

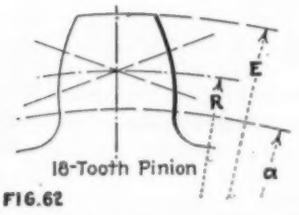


FIG. 62

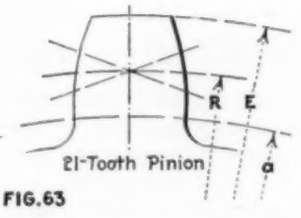


FIG. 63

Figs. 60, 61, 62 and 63—Tooth proportions of 12-, 15-, 18- and 21-tooth gears, 1 D.P. of the 20-deg. stub-tooth system

the active profiles do not extend to the undercut. Thus the duration of contact when two of these pinions mesh together is equal to

$$\frac{2(\sqrt{E^2 - a^2} - R \sin \alpha)}{Pn}$$

In this example, $R \sin \alpha = 2.0521$ in.

Whence length of contact between two 12-tooth pinions is 1.19 tooth intervals.

The contact in both cases is sufficient to give an overlap, but its value does not amount to 1.40 intervals which is a desirable minimum contact to secure, if possible. The contact is greater, however, than is obtained with a 12-tooth pinion made to conform with either of the two preceding gear systems, the 14½-deg. generated or the 14½-deg. full-depth.

The accompanying table gives values of the amount of undercut and contact for 1-D.P. gears of small numbers of teeth of the 20-deg. stub-tooth system. With this system, only the 12- and 13-tooth pinions are undercut, and the amount of undercut is so small that it has no appreciable effect on their action.

The forms of 12-, 15-, 18-, and 21-tooth gears made to this 20-deg. stub-tooth system are shown in Figs. 60, 61, 62 and 63 respectively.

Table X shows the amount of contact that exists between mating gears of small tooth numbers in this system. The values are expressed in terms of tooth intervals.

It will be seen from this table of contact that none of the combinations of gears with small tooth numbers give a contact of 1.40 tooth intervals. As stated before, the final design of any gear-tooth form is a compromise between several conflicting elements. Here, the amount of contact has been decreased in order to avoid excessive undercutting. This shortened contact imposes the necessity of greater care in production, if quiet running gears are to be obtained.

As before, we will examine other features of the contact conditions. The first table gives data that enable the minimum radius of curvature of the active profile and the specific sliding to be determined readily.

As a first example, we will examine a pair of 12-tooth pinions of 1 diametral pitch. The active profile extends to the tip of the tooth so that the maximum radius of curvature is equal to $\sqrt{E^2 - a^2}$, which equals 3.8014 in. The minimum radius of curvature of the active profile is equal to the total length of the line of action minus the maximum radius of curvature. The total length of the line of action is equal to $2R \sin \alpha$ which equals 4.1042 in., whence the minimum radius of curvature of the active profile is equal to 0.3028 in.

Table IX—Proportions of 20-Deg. Stub-Tooth Gear System

Number of Teeth N	Radius of Pitch Circle R	Radius of Base Circle a	Undercut Radius A	Root Radius H	Excess Depth of Cut e	Height of Undercut x	Radius to Top of Undercut Q	Outside Radius E	$\sqrt{E^2-a^2}$	$\sqrt{Q^2-a^2}$	$R \sin \alpha$
12	6.00	5.63814	5.09812	5.000	0.09812	0.00243	5.64057	6.80	3.8014	0.1682	2.0521
13	6.50	6.10799	5.53963	5.500	0.03963	0.00037	6.10836	7.30	3.9978	0.0668	2.2231
14	7.00	6.57783	5.98114	6.000	0.00000	0.00000	.....	7.80	4.1919	.....	2.3941
15	7.50	7.04768	6.42265	6.500	.....	.....	.....	8.30	4.3840	.....	2.5652
16	8.00	7.51752	6.86416	7.000	.....	.....	.....	8.80	4.5745	.....	2.7362
17	8.50	7.98737	7.30567	7.500	.....	.....	.....	9.30	4.7635	.....	2.9072
18	9.00	8.45721	7.74718	8.000	.....	.....	.....	9.80	4.9513	.....	3.0782
19	9.50	8.92706	8.18869	8.500	.....	.....	.....	10.30	5.1378	.....	3.2492
20	10.00	9.39690	8.63020	9.000	.....	.....	.....	10.80	5.3233	.....	3.4202
21	10.50	9.86675	9.07171	9.500	.....	.....	.....	11.30	5.5079	.....	3.5912
22	11.00	10.33659	9.51322	10.000	.....	.....	.....	11.80	5.6916	.....	3.7622
23	11.50	10.80644	9.95473	10.500	.....	.....	.....	12.30	5.8745	.....	3.9332
24	12.00	11.27628	10.39624	11.000	.....	.....	.....	12.80	6.0568	.....	4.1042
25	12.50	11.74613	10.83775	11.500	.....	.....	.....	13.30	6.2384	.....	4.2753
26	13.00	12.21597	11.27926	12.000	.....	.....	.....	13.80	6.4194	.....	4.4463
27	13.50	12.68582	11.72077	12.500	.....	.....	.....	14.30	6.6000	.....	4.6173
28	14.00	13.15566	12.16228	13.000	.....	.....	.....	14.80	6.7800	.....	4.7883
29	14.50	13.62551	12.60379	13.500	.....	.....	.....	15.30	6.9595	.....	4.9593
30	15.00	14.09535	13.04530	14.000	.....	.....	.....	15.80	7.1386	.....	5.1303

Table X—Length of Contact Between Mating 20-Deg. Stub-Tooth Gears in Terms of Tooth Intervals

No. of Teeth in Gear	Number of Teeth in Pinion															
	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
12	1.185															
13	1.193	1.202														
14	1.201	1.210	1.217													
15	1.208	1.217	1.225	1.232												
16	1.215	1.224	1.232	1.239	1.245											
17	1.221	1.230	1.238	1.245	1.251	1.257										
18	1.227	1.235	1.243	1.250	1.256	1.262	1.268									
19	1.237	1.240	1.248	1.255	1.261	1.267	1.273	1.279								
20	1.237	1.245	1.253	1.260	1.266	1.272	1.278	1.284	1.289							
21	1.237	1.250	1.258	1.265	1.271	1.277	1.283	1.289	1.294	1.298						
22	1.237	1.254	1.262	1.269	1.275	1.281	1.287	1.293	1.298	1.302	1.307					
23	1.237	1.258	1.266	1.273	1.279	1.285	1.291	1.297	1.302	1.306	1.311	1.315				
24	1.237	1.262	1.270	1.277	1.283	1.289	1.295	1.301	1.306	1.310	1.316	1.320	1.323			
25	1.237	1.266	1.274	1.281	1.287	1.293	1.299	1.305	1.310	1.314	1.320	1.324	1.327	1.330		
26	1.237	1.269	1.277	1.284	1.290	1.296	1.302	1.308	1.313	1.317	1.322	1.326	1.329	1.333	1.336	
27	1.237	1.272	1.280	1.287	1.293	1.299	1.305	1.311	1.316	1.320	1.325	1.329	1.332	1.336	1.340	1.343
28	1.237	1.275	1.283	1.290	1.296	1.302	1.308	1.314	1.319	1.323	1.328	1.332	1.335	1.339	1.343	1.346
29	1.237	1.278	1.286	1.293	1.299	1.305	1.311	1.317	1.322	1.326	1.331	1.335	1.338	1.342	1.346	1.349
30	1.237	1.281	1.289	1.296	1.302	1.308	1.314	1.320	1.325	1.329	1.334	1.338	1.341	1.345	1.348	1.351
Rack	1.237	1.331	1.401	1.408	1.415	1.421	1.426	1.432	1.436	1.441	1.445	1.449	1.453	1.457	1.460	1.463

We will also determine the specific sliding conditions. We have from a previous article

$$\text{Specific sliding on pinion} = \frac{b_1N_2 - b_2N_2}{b_1N_2}$$

$$\text{Specific sliding on gear} = \frac{b_2N_1 - b_1N_2}{b_2N_1}$$

Where b_1 = radius of curvature of any point on pinion tooth profile

b_2 = radius of curvature of mating point on gear tooth

N_1 = number of teeth in pinion

N_2 = number of teeth in gear.

In this example we have at the beginning of contact

$b_1 = 0.3028$ in.

$b_2 = 3.8014$ in.

N_1 and $N_2 = 12$, whence

$$\text{Specific sliding at beginning of contact} = \frac{0.3028 - 3.8014}{0.3028} = -11.55$$

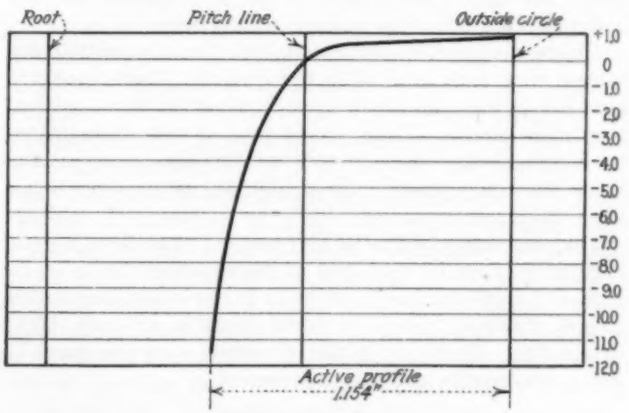


Fig. 64—Specific sliding between two 12-tooth, 20-deg. stub-tooth gears

The values of b_1 and b_2 are reversed at the ending of contact, whence we have

$$\text{Specific sliding at ending of contact} = \frac{3.8014 - 0.3028}{3.8014} = +0.92$$

The specific sliding is plotted in Fig. 64.

We will also determine the specific sliding conditions on this same 12-tooth pinion in mesh with a 30-tooth gear. The maximum radius of curvature of the active profile of the pinion is the same as before, but, as contact takes place down to the top of the undercut, the minimum radius of curvature of the active profile becomes equal to $\sqrt{Q^2 - a^2}$, which is equal to 0.1682 in. The corresponding radii of curvature on the 30-tooth gear are obtained by subtracting these pinion radii from the total length of the line of action, which equals 7.1824 in. Whence we have for the sliding conditions at the beginning of contact

$b_1 = 0.1682$ in.

$N_1 = 12$ teeth

$b_2 = 7.0142$ in.

$N_2 = 30$ teeth.

$$\text{Specific sliding on pinion} = \frac{0.1682 \times 30 - 7.0142 \times 12}{0.1682 \times 30} = -15.68$$

$$\text{Specific sliding on gear} = \frac{7.0142 \times 12 - 0.1681 \times 30}{7.0142 \times 12} = +0.94$$

And we have for the sliding conditions at the ending of contact

$b_1 = 3.8014$ in.

$b_2 = 3.3810$ in.

$$\text{Specific sliding on pinion} = \frac{3.8014 \times 30 - 3.3810 \times 12}{3.8014 \times 30} = +0.64$$

$$\text{Specific sliding on gear} = \frac{3.3810 \times 12 - 3.8014 \times 30}{3.3810 \times 12} = -1.81$$

This specific sliding is plotted in Fig. 65.

As a direct comparison with gears of the other two systems, we will examine the sliding conditions on a pair of 22-tooth gears, 1 D.P., made to the 20-deg. stub-tooth system. Here the contact extends to the top of the tooth, so that the maximum radius of curvature of the active profile is equal to $\sqrt{E^2 - a^2}$ which equals 5.6916 in. The minimum radius of curvature is

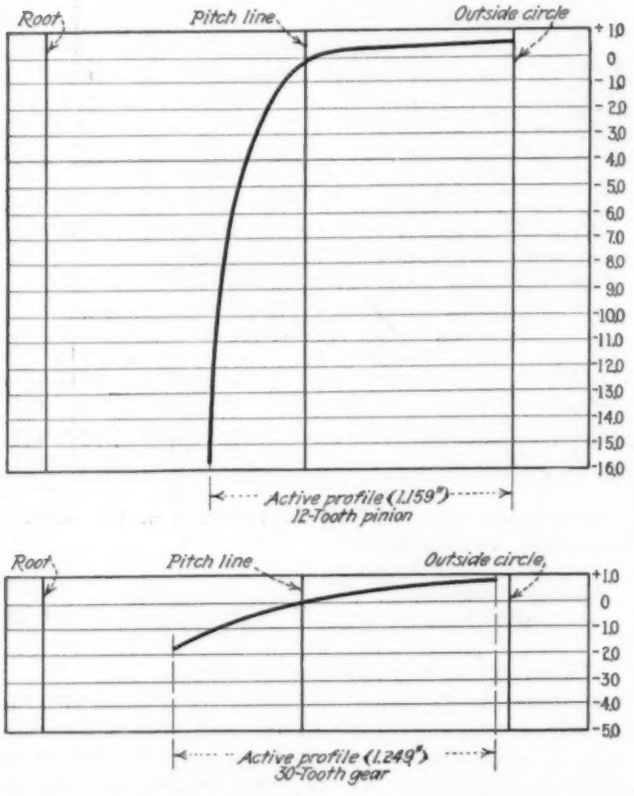


Fig. 65—Specific sliding between a 12-tooth pinion and a 30-tooth gear, 20-deg. stub-tooth system

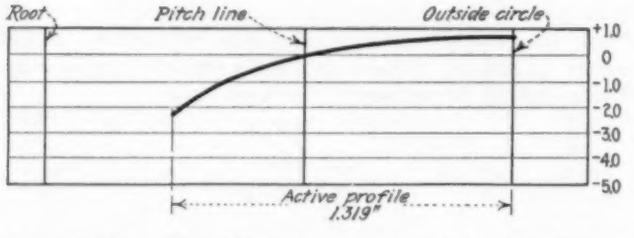


Fig. 66—Specific sliding between two 22-tooth, 20-deg. stub-tooth gears

obtained by subtracting this maximum radius from the total length of the line of action, which gives us 1.7328 in. as the minimum radius of curvature of the active profile. Thus we have at the beginning of contact

$$b_1 = 1.7328 \text{ in.}$$

$$b_2 = 5.6916 \text{ in.}$$

$$N_1 \text{ and } N_2 = 22 \text{ teeth}$$

$$\text{Specific sliding at beginning of contact} = \frac{1.7328 - 5.6916}{1.7328} = -2.28$$

The values of b_1 and b_2 are reversed at the ending of contact, whence we have

$$\text{Specific sliding at ending of contact} = \frac{5.6916 - 1.7328}{5.6916} = +0.69$$

This specific sliding is plotted in Fig. 66. The comparison of this chart with those shown in Figs. 49 and 58 show most favorable conditions for the 20-deg. stub tooth.

This 20-deg. stub-tooth form is very widely used for automobile transmission gears where the tooth numbers are small. It is also used to some extent for heavy mill gears with large tooth numbers, where the increased strength of the shorter teeth is a distinct asset.

In general, however, the 14½-deg. generated gear system is best adapted for gears with large tooth numbers, from 40 to 50 teeth and larger, while the 20-deg. systems are the best adapted to gears of small tooth numbers.

Limits of Accuracy in Repetition Work—Discussion

BY DOUGLAS P. MUIRHEAD
Glasgow, Scotland

Referring to an article by H. Applegard, under the title given above, and published on page 389, Vol. 63, of the *American Machinist*, I agree with Mr. Applegard that the effective diameter of a screw is the most important, and that it is much more satisfactory to control the manufacture of screws by the effective diameter. I have worked with the Wickman screw-gaging system for a number of years, and I find that it is an ideal system for controlling the production of screws to any limit the producer may consider satisfactory for his product. In this system the effective diameter is controlled within certain definite limits by means of a "Go" and "Not Go" caliper screw-gage, and any class of limit can be selected from fine to rough.

The two tables on page 390, one for Whitworth threads and one for drilled holes, are both unsatisfactory, since they do not give the operator any limit to work to on the different elements of the thread and the drilled holes. The first table refers to male screws, but it is also necessary to have some control over the female screws, which will only be as good as the taps by which they were made. These taps in turn must be accurate within certain limits. It is therefore of the utmost importance that the thing should be manufactured within reasonable limits, and to this end I have been using Wickman tap gages, which are very satisfactory for the rapid checking of quantities of taps. I may add that I am only a satisfied user of these gages, and am not connected with the makers in any way.

I have also had exceptionally good results with holes tapped with taps ground in the threads. Such taps are now being manufactured by a number of firms within very close limits. When using taps of this description, it is practically unnecessary to inspect them or the holes they tap, their only drawback at present being their high price.

I do not agree with Mr. Applegard that it is a good method to specify the class of fit required for a screw in a standard ring gage, since it is obviously impossible to get different people to agree what is an easy, tight or good fit. Opinions in this direction vary too much to get a reasonable working agreement.

Take plenty of time in designing a tool. Remember that thousands of parts may be manufactured with the tool and that a mistake may cause serious losses.

Forging Rings by the Upset Process

By J. C. Kielman
New Departure Manufacturing Co.

Nature of the rings—Class of steel—Tools and machines for upsetting—Difficulties encountered and their cure—Choosing the forging die—heat treatment

THE upsetting process has been in general use for many years in manufacturing a variety of small metal parts, such as rivets, bolts and nails. Only in recent years, however, has the method been used for making such parts as ball bearing-ring forgings. Several reasons may account for this. In the beginning the total number of bearings used was small, and it would not have paid to install the expensive equipment needed. The upsetting machinery manufacturers had only experience in making small parts, and their machinery was neither powerful enough nor well adapted for bearing forgings.

The principle involved in upset forging is simple, but the process requires well built tools, the careful setting of machines, and the expert handling of heats, to produce uniformly accurate forgings, and to obtain long life of the equipment

The principle in forging a ring is the same as in forging a bolt or rivet, but with the addition that after the head is formed on the end of the bar, the latter is held in a second set of tools and the center pierced out in another operation, leaving the ring. The center remains on the end of the original bar, and is used in the next forging. In this way the bar is successively forged into rings until finally it becomes too short to permit the dies to grip it for further upsetting.

The steel used for bearing races is S.A.E. 5210, which has the following analysis: Carbon, 0.95 to 1.10 per cent; manganese 0.20 to 0.50; phosphorus 0.30 max.; sulphur, 0.03 max.; and chromium, 1.20 to 1.50 per cent. The temperature at which the stock is forged is about 2,000 deg. F. If the metal is overheated, it is not only injured physically, but the bar will tend to slip back in the die as it is upset, and make a scant forging. If the bar is upset at too low a temperature, it shortens the life of the tools because of the extra pressure required.

In the case of cone forgings with holes from 1 to 1½ inches in diameter, and a very heavy section, it is necessary to use a bar as large in diameter as the hole, in order to gather sufficient stock to fill the forging without taking such a length that it will buckle in upsetting. In making most of the small cone forgings it is necessary to gather the stock in a large wad on the end of the bar as a preliminary operation to forming it in the die. In making a large light ring the diameter of the bar is smaller than the hole in the forging, since a bar of the same diameter as the hole would not extend through to touch the gage which is set to give the right length to make the forging.

One of the difficulties in making upset forgings is the "staggering" of hot metal toward one side as the bar is upset, which results in an off-center hole, a high flash on one side, and a scant forging on the other. This tendency is usually overcome by careful tool setting and by the use of the right diameter bar. The halves of the die must match perfectly in order to give a good round forging, and must stay matched under the pressure of upsetting.

A large part of the success of the upsetting operation is due to the quality of the tools. The job will not be productive if the tools have to be changed frequently. It is important that the tools be made of the best steel available for the purpose and heat-treated to secure their highest qualities. For upsetting-dies we found it necessary to use tungsten steels to get the necessary red hardness. The wear on the dies is much more severe than on drop hammer dies because the hot metal is in contact with the die under pressure a longer time in being upset. Another reason for more rapid deterioration of the upsetting die is that the hot bar extends through the die and heats the inside corners. If the heat is great enough to draw the temper of these corners, they will wash away quickly, and the forging will have a fin after it is pierced.

One of the difficulties in the use of high tungsten steels for upsetting-dies is that they are brittle if heat-treated to secure the full red hardness which they are capable of developing. This results in die breakage that is expensive. The wearing qualities of the dies are derived from the heating and quenching, and the resistance to breakage is due to the drawing treatment.

Dies for small forgings can be made economically of solid blocks of expensive tungsten steel, and the block will be strong and not easily broken. For large dies, which would require a pair of blocks 10 or 12 in. each dimension, the solid die of tungsten is very expensive, so that recourse is had to inserts of tungsten steel, placed in hardened die-blocks, the latter being used many times over. The die-blocks can be heat-treated to secure greater toughness than those of tungsten steel.

Abstract of paper presented at the Spring sectional meeting of the A. S. S. T. at Hartford, Conn., May 21, 1926.

On account of the rapid wear of the tools, it is not only necessary to set them properly in the beginning, but vigilance must also be exercised to see that the forgings continue good. Our method is to have an inspector assigned to each group of machines, and it is his duty to go from machine to machine measuring hot forgings from each one at short intervals. The greatest variation occurs in the width of the forging, because of the fact that a slight difference in the temperature at which it is forged will make a big difference in the plasticity of the hot metal. The hotter the metal the easier it will squeeze into shape in the die and the less it will cause the machine frame to spring when making the final squeeze. In addition, a very hot forging will naturally shrink more than a colder one, and because of this point the hotter forging will be narrower than the one made only a few degrees cooler.

The wear of the upsetting-die in the diameter, by washing out, gradually increases the outside diameter of the forging, and as the die gets more worn the forgings become larger than their original size so that it becomes necessary to discard the die. Another cause of variation in forgings is uneven wear of the upsetting-dies. It might be supposed that with care in hardening a die would wear evenly, but it often happens that the wear is greater on one side than another. This may be accentuated by the fact that the support given to the halves is not always equal, as one-half is held in a moving part of the machine. The result of the uneven wear is an uneven forging, which will often be made out-of-round, or slightly egg-shaped in the stripper during the piercing operation.

The Heat Treatment of Die-Blocks

By Alfred J. Porter, Jr.
Heppenstall Forge Co.

DROP forging received its big impetus with the advent of the automobile, and has expanded and grown with that industry until it is practically a part of it. Along with this growth the die-block has had to keep pace. The high-carbon, crucible-steel block originally used for hardware and bicycle parts could not be employed for the heavy forged automobile parts. Investigation proved that it was commercially impossible to harden large tool-steel blocks.

The alloy oil-hardened block is adapted for both simple and intricate impressions. It lowers the risk of breakage in hardening, and reduces warping and distortion. It also entirely eliminates the difficulties from checking, and is therefore well adapted for blocks where very long runs are desired.

Extreme care in selection of the analysis, in casting the ingot, and later in forging and upsetting of the block are necessary. Following these operations the annealing and heat-treating must be executed carefully to insure a product that will withstand the extreme service of continual hammering in the drop forge plant.

The first fault in heat-treating is that of placing a cold block in a furnace that is too hot. A block should never be charged in a furnace which is over 600 deg. F. Seventy-five per cent of hardening faults lie in improper heating previous to the quench. Blocks are heated too quickly, and the center is not brought up to the same heat as the outside. Sufficient time is not given to heat the steel thoroughly. A safe amount of time to allow is one hour per inch of thickness. The result of quick heating is a cracked or broken block, because the unevenness of the heating sets up strains that cannot be controlled.

When a new pair of dies are started in the hammer it is good practice to "baby them" until the first few hundred forgings have been made. By that time the blocks will have been smoothed up well, and will be ready for steady forging. This preparatory work can be accomplished by heating the bars hotter than ordinary, and taking more and lighter blows to make the first few hundred forgings. If dies stick slightly they should be dressed until this fault has been eliminated. It is well to avoid the excessive use of oil in the impressions when the forgings are sticking. This sticking can be eliminated by spending a little time in smoothing up the impression. The time spent is refunded many times in the increased production.

When hardening die blocks it should be kept in mind that hardness is not the only essential. The tempering is just as important. The block should be heated face up in a furnace large enough to insure a uniform heat throughout the block. It is well to cover the face of the die to prevent scaling if there is much oxidation in the furnace. At the start of the quench the die should be totally immersed and left beneath the oil until it is cooled so that it will not flash the oil. Then it should be raised and left at about one inch below the depth of impression, with the shank protruding.

The most practical method for drawing drop-forge blocks is the hot plate. The die should be placed shank down on the plate and the heat forced into it quickly at the start. To insure this it is well to have the hot plate made in two sections so that the sections may be pulled apart and the shank dropped down over the flame from the burners. As the heat commences to come through the die it can be raised and the plates pushed together. The block should be drawn back to a slightly higher temperature than it will receive in the actual forging operation. If the forging is allowed to heat the die to a higher degree than the draw temperature the die-blocks will be badly checked.

In the average die-block hardness is not essential for long wear. Toughness and a comparatively soft block are more desirable. The result is that drop forgers are using blocks that are furnished to them heat-treated, and on which they do no further hardening after sinking. If the shop has done the hardening, the heat of the forging will draw the block back to approximately the same hardness at which it could purchase and sink heat-treated blocks. The heat-treated blocks take about 25 per cent longer time to sink, but the dies can be put under the hammer immediately. Any possibility of breakage and distortion in hardening is thus avoided. Furthermore, when the heat-treated block is worn down it is not necessary to anneal and cut away the old impression entirely before resinking. It is merely required to dress down the existing impression without annealing.

Abstract of a paper presented at the Spring Sectional Meeting of the A.S.S.T. at Hartford, Conn., May 21, 1926.

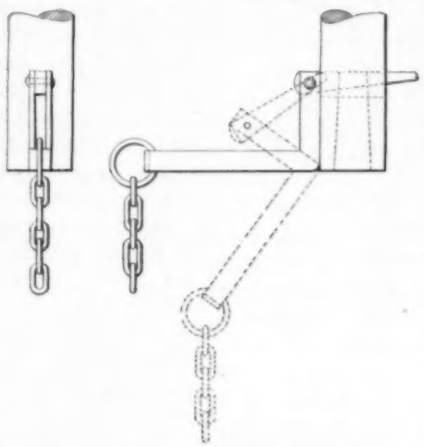
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Self-Releasing Drift for Small Drill Presses

BY NORMAN MOORE

Accidents sometimes happen because of someone carelessly leaving a drift in the slot of a drill-press spindle after having knocked out a chuck or drill and carried it away for use elsewhere. Such an accident is most likely to happen in drill presses having two or more spindles, all driven from one back-shaft. Someone sets up a job under another spindle and, not noticing the protruding drift nearby, starts up the machine and out flies the drift. A means to forestall such an accident is shown by the accompanying sketch, in the form of a self-releasing drift. To make it, cut a piece of sheet steel about ⅛ in. thick and double it upon itself in the manner here shown. The open ends are attached to the end of the drift by means of a loosely fitting pin, so that the device will swing freely. A ring, placed at the bend of the piece before pinning the latter to the drift, serves to attach the chain by which the drift is fastened to the machine.



A safety drift for small drill presses

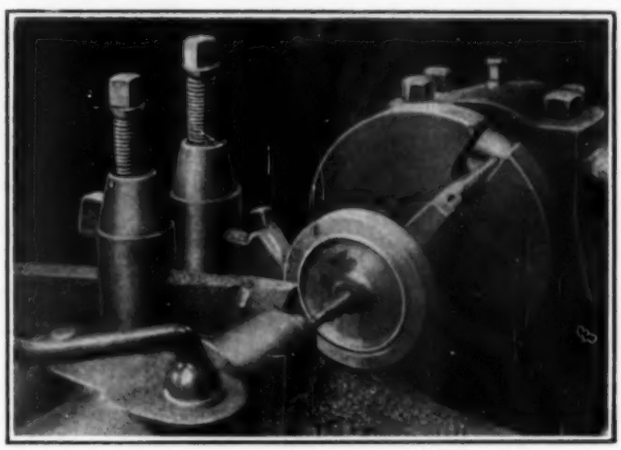
The drift is used in the regular way, but it cannot be left in the slot for the reason that the weight of the chain, acting upon the outer end of the bent lever, will cause it to be withdrawn automatically, and it will fall to the table of the machine.

Turning Small Balance Wheels in an Engine Lathe

BY MILTON WRIGHT

The illustration shows how an engine lathe is tooled up to turn and face small balance wheels. The job is one of production, and the operator runs two or more lathes as the size of the wheel and consequent cutting time will permit.

Two toolposts are used in the T-slot of the toolblock by making special leveling blocks to replace the usual cradle and ring. The first tool is set to turn the diameter of the wheel, and an inward stop on the cross-slide



Production work on an engine lathe

enables the operator to position the tool for the cut without delay.

The regular feed of the lathe is used, but as soon as the cut is completed across the periphery of the wheel, the feed is automatically thrown out. The operator then advances the carriage toward the headstock by hand until it contacts with a fixed longitudinal stop, when the side tool is in position for the facing cut. The automatic cross feed is then engaged.

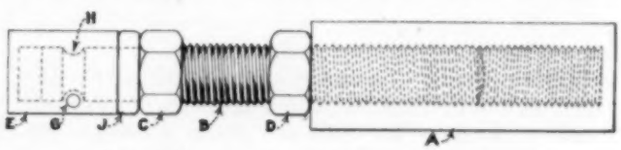
By having two lathes set up on one size of wheel, one roughing and the other one finishing, a very creditable rate of output is attained without the necessity for the larger investment involved in a special machine.

An Adjustable Stop for the Screw Machine

BY ARTHUR W. MYERS

The sketch shows an adjustable stop that can be used on any screw machine, plain or automatic.

The shank *A* is held in the turret in the usual manner. The threaded part *B* can be screwed in or out by using a wrench on the hexagon *C*, and when adjusted can be



Adjustable stop for the screw machine

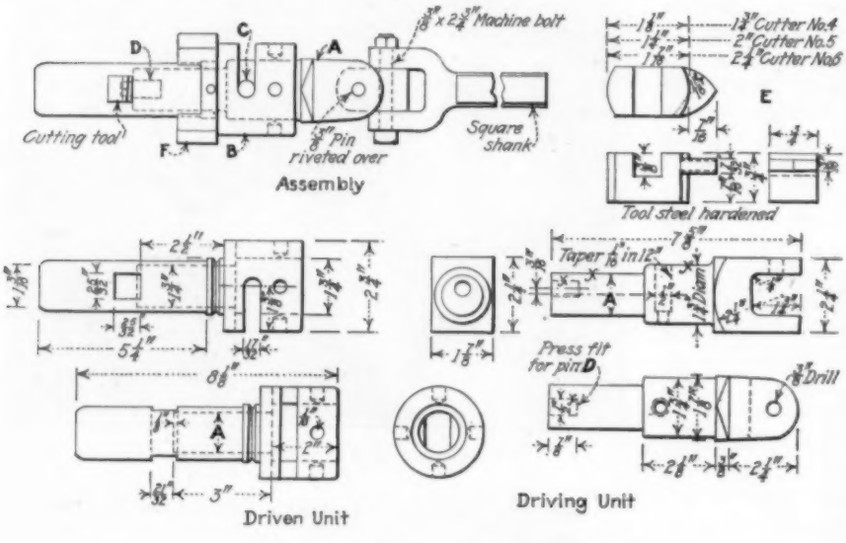
locked by the nut *D*. The part *E* is free to revolve and is held in place by the pin *G*, which is a free fit in the groove *H*. The fiber washer *J* takes the thrust of the revolving part when the stock is brought against it.

Air-Operated Flue Cutter

BY GEORGE FELTNER

Nearly all railroad shops use an air-operated tool for cutting out old flues from the boiler but the design of tool differs in most cases. The other day I ran across an odd type that seemed somewhat different from the average. The tool employs a principle that has to be studied carefully in order to understand its operation. It is being used at the Silvis shops of the Chicago, Rock Island and Pacific Railroad.

The flue cutter consists of the driving unit *A* that is assembled into the driven unit *B* so it can revolve freely therein. However, the revolving action is limited by the pin *C*, assembled as shown, limiting the turning action to one-half revolution. This pin also holds both units together, longitudinally. On the operating end of the driving unit is mounted the drive pin *D*, eccentric with the centerline, a distance of $\frac{1}{16}$ in., as shown in the detail drawing. The projecting end of the pin fits into a slot in the cutting tool, details of which are shown at *E*. The cutting tool is made to slide in the square hole of the driven unit. Therefore, by holding stationary the driven unit and revolving the driving unit, the cutting tool is caused to move in or out according to the direction of the turning.



Details of air-operated flue cutter

In operation, the front end of the flue cutter is inserted into the flue far enough to allow the locating plate *F* to strike or stop against the flue sheet, the operator making sure the cutting tool is in its inward position. The air motor then is connected to the square driving-shank, shown at the right-hand side of the assembly view. The entire assembly revolves when the motor is started, causing the drive pin *D*, which is interlocked with the cutting tool, to act as a drive between the driving and driven units. This action is the result of the cutting tool being forced out against the inside surface of the flue and being prevented from taking its farthest outward position. When the tool is stopped from further outward movement, the pin *D* acts as a crank, forcing the driven unit to revolve. Since the entire pressure is brought on the point of the tool, it has a tendency to break through the flue as soon as a few revolutions have been made, upon the completion of which the flue is completely cut off. The action produced is a shearing operation. The average life of the cutting tool is two sets of flues or approximately 400. The flues are cut out at the rate of 75 per hour.

Reducing Tube-Piercing Costs

BY WARREN SCHOLL

Many manufacturers whose product requires the piercing of tubing still use the old method of holding the tube in a fixture and drilling it, although there are many cases where a pierced hole would serve the purpose. One manufacturer of metal beds who had large numbers of steel tubes to be pierced, designed a sets of dies which punched a $\frac{11}{64}$-in. hole through both sides of a $\frac{7}{8}$-in. steel tube, with very good results. The fact that the operation, piercing two holes, when done in a drill press, cost about $1 per hundred operations, and when done in a die cost about 20c. per hundred operations, certainly makes the die method worthy of consideration.

A perspective drawing of the piercing die with its device for removing the tubing after it has been pierced is shown in Fig. 1. In use, the tubing is inserted in the hole in the extractor block and pushed over the mandrel *A* in the die, back against the gage *B*. The punches pass through the guide holes, shown in cross section in Fig. 2, through the top wall of the tube, through the mandrel, through the bottom wall of the tube, and into the lower die. It will be noted that the mandrel acts as the upper die.

The slug punched from the upper wall of the tube is carried down with the punch and is pushed through the lower wall ahead of the punch. While the hole punched is not absolutely true to form, it has been found entirely satisfactory for this class of work. When the mandrel is new, the tube may be withdrawn without the use of an extractor, but as the mandrel becomes worn, the top holes become burred and the tubing slightly flattened, making the withdrawal of the

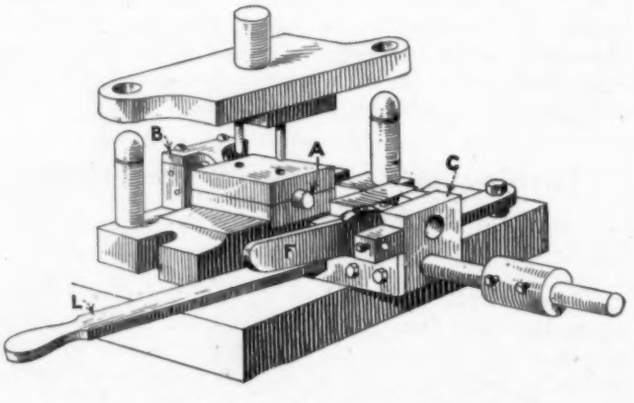


Fig. 1—Tube-piercing die

tube so difficult that the extractor device *C* is necessary.

The tube-extractor block has a fixed jaw *D* and a sliding jaw *E*. The latter being actuated by the cam lever shown at *F*. The entire extractor block slides on a rod screwed into the bottom die-shoe, and is actuated by a long lever pivoted to the bolster plate. To remove the tube, the operator raises the cam lever *F* to grip the tube, and while holding up this lever with one hand pulls out the extractor block containing the tube with the long lever *L*.

The most troublesome part of this die is the mandrel. If the mandrel is too hard it will break at the holes. If it is too soft, it will wear quickly and cause the punches to flatten the tubing before piercing. The diameter of the mandrel, too, is an important factor. If it is too large, there will be difficulty in getting the tubing over it. If it is too small, it will not be supported on the

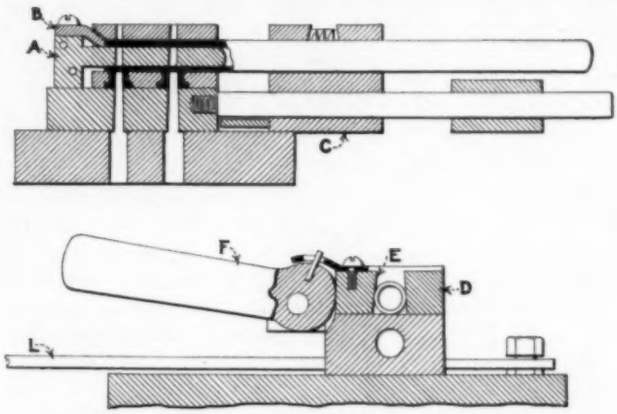


Fig. 2—Cross section of tube-piercing die

bottom by the thickness of the tubing wall, and it will break. However, for the $\frac{1}{8}$-in. diameter tubing previously referred to, the best results were obtained by making the mandrel diameter 0.010 in. less than the inside diameter of the tubing. With this clearance, close to 100,000 operations were obtained from one mandrel. Obviously the mandrel can not be sharpened, and a new one must be inserted when the one in use becomes worn.

Chart for Use in Metal Drawing

By L. Coleman Douglas

Having had considerable experience in the drawing of both brass and steel shells, I have found it of great advantage to use a curve to determine the diameter of shell for the first draw, for any given blank diameter up to 18 inches.

A curve of this kind plotted to large scale, and available in the drafting room, will save many hours of valuable time. As an illustration of its use in the drawing room, suppose we have a finished shell that will require a blank diameter of 17 in. By referring to the curve in the illustration, and tracing along a horizontal line from the 17-in. blank diameter to the curve, then down vertically (note dot and dash line on curve), the diameter of the shell for the first draw will be found to be $11\frac{7}{8}$ in. Or if the shell needed requires a blank 10 in. in diameter, the diameter of the shell for the first draw will be found to be $5\frac{1}{2}$ in.

It is understood that in using the curve, no reduction in metal thickness is advisable.

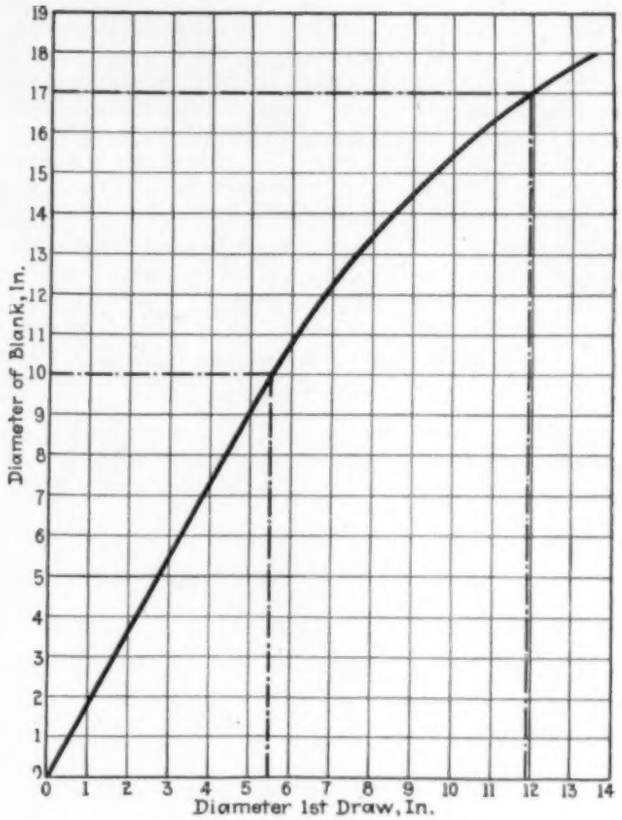


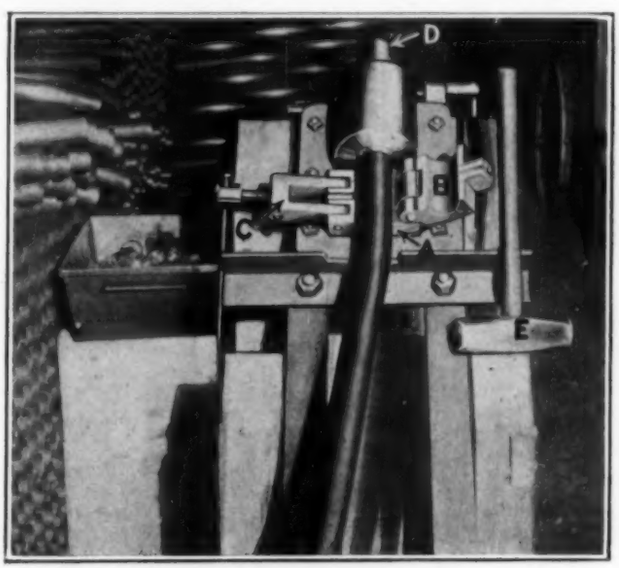
Chart for use in drawing metal

Believing a chart of this kind to be quite a time saver and, since the curve was plotted from actual data from parts now in production, I am passing it along to the many readers of the *American Machinist* for their comments.

Simple Fixture for Flaring Pipe

By Frank C. Hudson

It is common practice to flare, rather than flange the end of the exhaust pipe on automobile engines, for the nut that holds the pipe to the exhaust manifold. This



Flaring the ends of exhaust pipes

operation is done very quickly in the plant of the Cleveland Automobile Co., in a simple fixture.

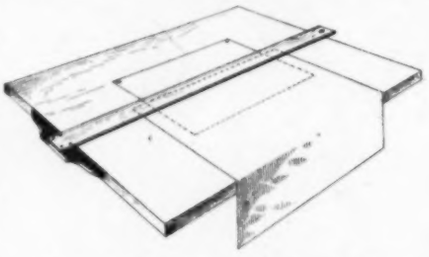
The pipe is laid in the block *A*, with the end against the plug shown. The hinged jaw *B* is swung over and is held securely by the clamp *C*. Then the swaging or flaring plug *D* is struck with the heavy hammer *E*, and the end is flared to the desired amount, usually in one blow.

The apparatus is mounted on an inclined stand made of angles, while the uprights are 4x4-in. timbers to give rigidity and help absorb the blows.

How to Keep Drawings Clean

By H. S. Steele

When a considerable amount of time is involved in completing a drawing, the draftsman will find that it is almost impossible to keep it clean, due to smutted pencil lines from moving the T-square up and down and brushing the arm back and forth across the paper. If the drawing is to be inked in, it can easily be cleaned with a sponge eraser, but if the drawing is not to be inked in, it is almost impossible to clean it. I have found that if a piece of tracing paper a little larger than the drawing is pasted to the under side of the T-square, it will act as a screen or curtain moving up and down with it.



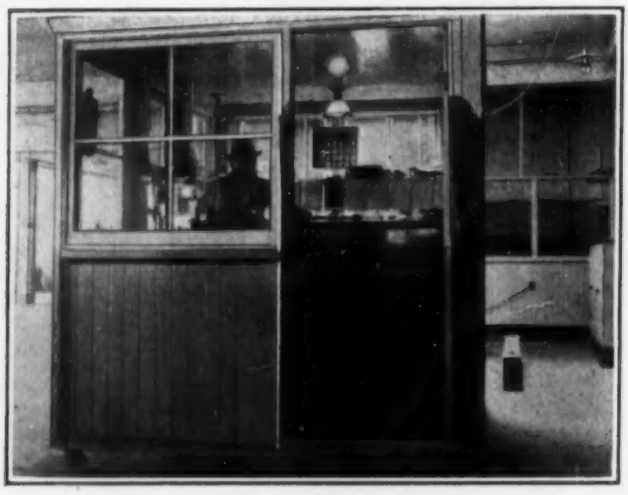
How the drawing was kept clean

A sketch showing the idea is enclosed and I have found that although it does not keep the drawing spotlessly clean, it does help me to turn out a neater drawing.

A Portable Office in the Machine Shop

By C. W. Geiger

The accompanying illustration shows a portable office in a San Francisco machine shop, and has many advantages over the usual permanent office for the foreman or superintendent. The entire sides of the office are of glass, which permits light to flood the interior.



The portable office

Ventilation is provided by means of a door and a window, the window being primarily for the transaction of business between the foreman or superintendent and the workmen. The window also permits workmen or others on the outside of the office to use the telephones, which are placed on a shelf just inside.

There are sockets at three different points in the ceiling, for electric light, current for the lights and an electric heater being carried by an extension cord placed on the top of the office. A roll of telephone wire is also placed on the top of the office. When the office is to be moved, the extension cord is disconnected from the socket and plugged in on another socket near the new location. The roll of telephone wire makes it unnecessary to disconnect the telephone when the office is in transit (except of course when it is moved to another floor.)

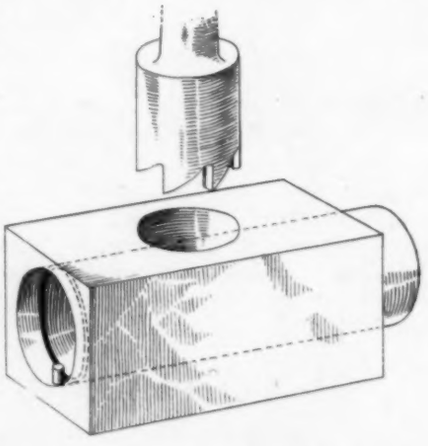
A special cabinet or desk has been built across one end of the portable office for use of the foreman.

How Would You Do This Job?—Discussion

By Richard H. Kiddle

In reference to a letter under the above title by Henry Densmore, published on page 904, Vol. 63, of the *American Machinist*, asking how a certain job was, or might be, done, here is the way we did it some time ago. The sizes were not the same as those given by Mr. Densmore but the method is applicable to any size.

We made a fixture by drilling a hole endwise through a piece of square stock, the diameter of the hole being such that the tube to be operated upon would fit it closely. From one side of the block we drilled a hole of the same diameter as the desired transverse hole in the tube. A pin, driven into a small drilled hole in one side of the fixture and projecting into the central hole, was the gage to locate the transverse hole from the end of the tube.



Tools to make hole in wall of tube

The tool was a hollow mill, and was used in the spindle of a drill-press. Our mill had only four teeth in it, so that there was plenty of room for the chips. A different number of teeth might be desirable for different thicknesses of wall, or for other material. Our material was Shelby steel tubing.

We used a sort of hand punch to knock the tubes out of the jig after they were drilled. With the exception of this punch, all of the tools are shown in the accompanying sketch.

One of the problems of die-casting is to provide vents for the escape of air from the molds. Otherwise it is impossible to obtain sharp corners or to completely fill the mold with metal.

Weight of Brass Stock for Screw Machine Parts

Hexagon Brass Rod				Round Brass Rod			
1 Across Flats—in.	2 Multiply Length in In. By:	3 And Add for $\frac{3}{32}$ in. Cut-off:	4 For $\frac{1}{16}$ in. Cut-off:	1 Diameter—In.	2 Multiply Length in In. By:	3 And Add for $\frac{3}{32}$ in. Cut-off:	4 For $\frac{1}{16}$ in. Cut-off:
$\frac{1}{16}$	1.06	0.10	0.07	$\frac{1}{16}$	0.96	0.09	0.06
$\frac{3}{32}$	2.37	0.22	0.15	$\frac{3}{32}$	2.15	0.20	0.13
$\frac{1}{8}$	4.22	0.40	0.26	$\frac{1}{8}$	3.83	0.36	0.24
$\frac{5}{32}$	6.60	0.62	0.41	$\frac{5}{32}$	5.98	0.56	0.37
$\frac{3}{16}$	9.50	0.89	0.59	$\frac{3}{16}$	8.62	0.81	0.54
$\frac{7}{32}$	12.94	1.21	0.80	$\frac{7}{32}$	11.73	1.10	0.73
$\frac{1}{4}$	16.90	1.59	1.06	$\frac{1}{4}$	15.33	1.44	0.96
$\frac{9}{32}$	21.39	2.01	1.34	$\frac{9}{32}$	19.40	1.82	1.21
$\frac{5}{16}$	26.40	2.47	1.65	$\frac{5}{16}$	23.95	2.24	1.50
$\frac{11}{32}$	31.95	3.00	2.00	$\frac{11}{32}$	28.98	2.72	1.81
$\frac{3}{8}$	38.02	3.56	2.38	$\frac{3}{8}$	34.48	3.23	2.16
$\frac{13}{32}$	44.62	4.18		$\frac{13}{32}$	40.47	3.79	
$\frac{7}{16}$	51.75	4.85		$\frac{7}{16}$	46.93	4.40	
$\frac{15}{32}$	59.40	5.57		$\frac{15}{32}$	53.88	5.05	
$\frac{1}{2}$	67.59	6.34		$\frac{1}{2}$	61.30	5.75	
$\frac{17}{32}$	76.30	7.16		$\frac{17}{32}$	69.20	6.49	
$\frac{9}{16}$	85.54	8.02		$\frac{9}{16}$	77.58	7.27	
$\frac{19}{32}$	95.31	8.93		$\frac{19}{32}$	86.44	8.10	
$\frac{5}{8}$	105.61	9.90		$\frac{5}{8}$	95.78	8.98	
$\frac{21}{32}$	116.44	10.91		$\frac{21}{32}$	105.60	9.90	
$\frac{11}{16}$	127.79	11.97		$\frac{11}{16}$	115.90	10.86	
$\frac{23}{32}$	139.67	13.10		$\frac{23}{32}$	126.67	11.88	
$\frac{3}{4}$	152.08	14.26		$\frac{3}{4}$	137.93	12.93	
$\frac{25}{32}$	165.02	15.47		$\frac{25}{32}$	149.66	14.03	
$\frac{13}{16}$	178.49	16.73		$\frac{13}{16}$	161.87	15.17	
$\frac{27}{32}$	192.48	18.05		$\frac{27}{32}$	174.57	16.37	
$\frac{7}{8}$	207.00	19.41		$\frac{7}{8}$	187.73	17.60	
$\frac{29}{32}$	222.05	20.82	For $\frac{1}{8}$ In. Cut-off:	$\frac{29}{32}$	201.38	18.88	For $\frac{1}{8}$ In. Cut-off:
$\frac{15}{16}$	237.63	22.27		$\frac{15}{16}$	215.51	20.20	
$\frac{31}{32}$	253.73	23.78		$\frac{31}{32}$	230.12	21.57	
1	270.37	25.35	33.80	1	245.20	22.99	30.65
$1\frac{1}{16}$	305.20	28.61	38.15	$1\frac{1}{16}$	276.80	25.95	34.60
$1\frac{1}{8}$	342.18	32.07	42.77	$1\frac{1}{8}$	310.33	29.09	38.79
$1\frac{3}{16}$	381.25	35.75	47.65	$1\frac{3}{16}$	345.76	32.42	43.22
$1\frac{1}{4}$	422.45	39.61	52.80	$1\frac{1}{4}$	383.14	35.92	47.89
$1\frac{5}{16}$	465.76	43.66	58.22	$1\frac{5}{16}$	422.41	39.60	52.80
$1\frac{3}{8}$	511.16	47.92	63.90	$1\frac{3}{8}$	463.59	43.46	57.95
$1\frac{7}{16}$	558.70	52.37	69.84	$1\frac{7}{16}$	506.71	47.50	63.34
$1\frac{1}{2}$	608.31	57.03	76.04	$1\frac{1}{2}$	551.69	51.72	68.96
$1\frac{9}{16}$	660.08	61.88	82.51	$1\frac{9}{16}$	598.65	56.12	74.83
$1\frac{5}{8}$	713.92	66.93	89.24	$1\frac{5}{8}$	647.48	60.70	80.93
$1\frac{11}{16}$	769.90	72.18	96.24	$1\frac{11}{16}$	698.24	65.46	87.28
$1\frac{3}{4}$	828.00	77.62	103.50	$1\frac{3}{4}$	750.94	70.40	93.87
$1\frac{13}{16}$	888.21	83.27	111.02	$1\frac{13}{16}$	805.55	75.52	100.69
$1\frac{7}{8}$	950.52	89.11	118.82	$1\frac{7}{8}$	862.05	80.82	107.76
$1\frac{15}{16}$	1014.93	95.15	126.87	$1\frac{15}{16}$	920.47	86.29	115.06
2	1081.47	101.38	135.17	2	980.82	91.95	122.60

For a given size of rod, multiply the length of the piece in inches by the figure in column 2, and add to the result the figure in column 3, or that in column 4, according to the size of cut-off tool used. The result is the weight in pounds of stock required for 1000 pieces.

For steel rod multiply by 0.928.

Contributed by D. Ruotolo

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Wood Block Floors in the Shop

Q. We have a wood block floor in our erecting shop that has become badly worn from heavy trucking. We desire to replace sections of the aisles, and understand that there is a wood block used for this purpose that is harder and more durable than the ordinary treated block. We cannot trace this material, and would appreciate any information you can give us.

A. It is probable that you have reference to the tropical hardwood blocks that are much employed for street paving as well as for shop floors. Red quebracho is the most durable of these woods. It is an intensely hard wood containing more than 25 per cent of tannin. The latter acts as a natural preservative, and the wood needs no other treatment. Crossties of quebracho have been known to last more than 50 years in service. However the lumber has to be imported, and is very difficult to saw, so that blocks of quebracho are much more expensive than creosoted blocks of native woods. The quebracho industry is largely in the hands of one or two companies.

Glazing of Grinding Wheels

Q. Is there any practical way of preventing glazing of the grinding wheel in surface grinding on cast iron?

A. You should have little difficulty from glazing of the wheel if all of the operating conditions are right. See that your wheel is not too fine or too hard, and that the feed is sufficient. A fine feed will glaze the wheel. Another point is in the proportion of oil in the cutting lubricant. If too much oil is used it will have a tendency to glaze.

Heating Tools in the Lead Bath

Q. We are making considerable quantities of small tools that have to be hardened. We are now employing an ordinary gas furnace. What advantage would we gain by installing a lead bath, and will the cost be higher than with a gas furnace?

A. Lead has a working temperature range from 650 deg. F. to 1,700 deg. F., and the heat of the bath can be controlled accurately at any desired temperature within the range. The high heat conductivity of lead permits greater output by rapid heating, at the same time ensuring a uniform temperature throughout the bath. The lead bath is especially recommended for pieces that can be handled in bulk because of the even distribution of heat. It is also useful in hardening any tool that requires local heating, as the piece can be manipulated in such a way that it will have a number of hard and soft sections.

The first cost of installation of a lead bath is usually less than that of an oven gas furnace, but the cost of operating the lead bath is often higher. You will find it most advantageous not to change abruptly from one to the other, but to select the work most adaptable to each. On some work the extra cost of treating in the lead bath will be more than made up by the more even class of production. On the other hand, for quantity production a saving in cost can often be made with the lead bath.

Size of Tube for a Given Thread

Q. The aluminum end on one of our standard articles is die-cast to 1.315 in., and then chased to 1.305 in. outside diam., with 24 threads per inch, U.S.F. We wish to fit these into tube handles. Can you tell us how to establish the correct inside diameter of the tube for the correct thread?

A. Assuming that the figure of 1.305 in. is the correct diameter size across the flats, you can calculate the other dimensions by means of the formulas for the standard thread. These are: $p = \frac{1}{n}$ and $d = 0.6495p$, where p equals the pitch, n the number of threads per inch, and d equals the depth of the thread. In your case the pitch is 0.04166 in. and the depth of thread is 0.02758 in. The inside diameter of the tube, for full depth thread, therefore, is 1.305 minus twice the depth of thread, or 1.2519 in. On a commercial fit you can allow a variation above this size that will permit you to grant a tolerance on the tube dimension.

Gear Ratio Calculation

Q. In one of our machines a ribbon passes over a sand-roll 14½ in. in diameter. A shaft containing a ratchet wheel is geared up with the sand-roll shaft by two intermediate gearshafts. The gear combination from the sand-roll shaft is 66:15:58:15:50:13. I would like to know how many teeth I must have in the ratchet wheel to make 64 picks to one inch of ribbon.

A. Your problem can be solved by simple arithmetic. The gear ratios give a speed of $\frac{66}{15} \times \frac{58}{15} \times \frac{50}{13}$, or 65.38 revolutions of the ratchet wheel for one revolution of the sand-roll shaft. The circumference of the sand-roll is 3.1416 × 14.5 in., or 45.553 in. Therefore, for every revolution of the sand-roll 45.553 in. of ribbon will pass by the ratchet wheel shaft, while the latter is turning 65.38 times. Thus, the ratchet wheel will turn $\frac{65.380}{45.553}$, or 1.43 times, while each inch of ribbon is passing. In other words, the ratchet wheel will turn through 360 deg. × 1.43, or 514.8 deg., for every inch of ribbon. The picks in the ratchet wheel, therefore, should be spaced $\frac{514.8}{64.0}$, or 8 deg. apart. The slight error is negligible. Dividing 360 by 8 we get 45, which is the number of picks on the ratchet wheel.

Technical Abstracts

Krupp "Mikrotast" Gages

The Krupp Works at Essen has developed a set of measuring devices which are considered a great simplification over "go and no-go" gages. The devices involve a micrometer indicator but the indicator has no gears. It is a lever device with knife-edge bearings made of two parts so that practically no play is observable. The gages are adjustable but endurance tests have shown that the micrometer indicator does not vary its indication after 1,200,000 readings. Resetting is, therefore, very rarely necessary. The gages are comparators, that is, they are meant to show variation from a master piece. They can show variation from true arc form and in angular distance as well as in linear dimensions. The outside gage is made with an angular rider, that is, it does not touch the part to be measured at two ends of a diameter. The inside gages are either expanding or non-expanding. A comparison with ordinary limit gages shows a considerable saving in the number of gages to be kept on hand and in the wear of gages. The original article gives numerous illustrations of the gages themselves and the way they are used. M. Bartholdy in *Die Werkzeugmaschine*, April 15, p. 187.

Budgeting

Budgeting is often thought to be difficult, expensive and involving a large amount of red-tape. Budgeting, however, is a scientific method of planning operations and estimating costs of the various phases of a business by co-ordinating all functions and controlling the results obtained by a comparison with the estimates made. It is primarily a means of securing internal control of every phase of a business. All companies probably do some form of budgeting but the average concern can well afford to budget all its operations.

The successful operation of a budget system depends to a great extent upon the ability of the management to enlist the co-operation of every employee in a supervisory or managerial position. These men may be willing to estimate operations for a future period, but unless they co-operate to the fullest extent to keep actual performances within the budget, the real purpose of the budget will be defeated. Chester P. Grassmuck, Tidewater Oil Co., in *The Management Review*, May, 1926, p. 131.

The Negro at Work

In the automobile plants of Detroit the proportion of Negro workers increased from one-half of one per cent in 1910 to .35 per cent in 1920. Despite the objections encountered at first from the unions of skilled trades the number of skilled Negroes has increased. Large numbers of Negroes went into the steel mills of the Pittsburgh district in 1917 and again in 1918. In 1923 an inquiry revealed 16,900 employed in 23 of the largest mills of the district, constituting about 21 per cent of the total working force. An inquiry directed to 600 plants in eight northern cities shows that two-thirds of the plants were satisfied with the quality of the work done by the negro. Among the others some had found them satisfactory only under white leadership; some found them satisfactory only for certain kinds of work and some could not use them satisfactorily anywhere. Charles S. Johnson in *Industrial Psychology*, June, 1926, p. 399.

Steel for Shop Tools

Steel specifications which merely specify chemical analysis and tolerances and include meaningless sterotyped phrases are of little advantage to either user or supplier. But a specification which maintains reasonable manufacturing variations of analysis and tolerances, which gives a workable range of physicals; a specification that tells the manufacturer what is wanted and also tells what, in the opinion based on experience in your own shop, will best meet these requirements, should be a help to the manufacturer.

It is costly to inspect steel and it also is costly to build tools from seamy or defective steel. For a small plant which cannot afford a technical staff and microscopic equipment, the minimum inspection should be a visual examination; microscopic hot acid etch test and a Brinell test.

Visual examination requires considerable experience but should be used by all in the detection of seams, slivers, etc. This forms the major part of all mill inspections other than heat analysis. In some cases, this is supplemented by the fracturing of an annealed bar, and in some cases of a hardened bar. For the detection of manufacturing defects, the macroscopic hot acid etch test gives more information at less cost than any other. This test is not difficult to make and can be carried out by men having only slight experience in handling steels. It will disclose decarburization, seams, scabs, flakes, slag, slivers and inhomogeneity in general. A Brinell test shows the uniformity and the degree of anneal. In larger companies, these tests are supplemented by the microscope.

For blanking punches and dies on jobs such as nickel silver, carbon tool steel sheet and silicon steel sheet, in general, high-speed steel is favored over carbon tool steel since it is found that it gives longer life. For these tools, no red hardness is involved. For soft steels, brass, copper, etc., the economies to be effected by changing from carbon to high-speed still is a debatable subject.

As a result of observing thirteen different blanking tools operate through 113 setups over a period of eighteen months, a tool standardization department found that in 46 per cent of the cases, the setups were taken down for some reason other than that the tool became dull. In 54 per cent of the cases where the tool did get dull as shown by throwing a burr on the piece and causing its rejection in the inspection department, the careful selecting of any two or three week period of production would have shown any of the thirteen tools to be better than the others. J. B. Mudge, Western Electric Co., in *Iron Trade Review*, April 29, p. 1116.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

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The Foreman and His Pay Check

A HEALTHY interest is being displayed in the problem of foremen training and in foremanship in general. We are being reminded that foremen are a most important consideration in modern production.

In too many cases, however, the rather important point of proper remuneration for these "key men of industry" seems to have been overlooked. If the industry depends on foremen—and it does to a larger extent than many realize—they should certainly receive a much larger income than is frequently the case. In some instances piece-rate workers, who know nothing but the single operation, will get as much or more than their foreman, and with none of his responsibility. Good foremen earn a good salary—and they should get it.

What Is the Average Age of Your Machine Equipment?

FOR some months, now, the "American Machinist" has been sending out questionnaires to machine shops all over the country asking for information on the age of the machine tools in use. Results for the railroad repair shops have been published. They showed that 65 per cent of the tools in use were more than ten years old.

One superintendent, not of a railroad shop, who filled out his questionnaire got interested in the figures and calculated the average age of each class of tool in his shop. Some two or three classes showed an average age that seemed entirely satisfactory but the others—well, when the averages showed fourteen and eighteen years he was so dumfounded that he immediately put through requisitions for twenty thousand dollars worth of new equipment.

It will be worth your while to work out averages for your own shop, but don't do it if you have a weak heart, the shock may be fatal.

Labor and Scientific Management

AS RECENTLY as ten years ago scientific management and organized labor were considered to be about as far apart in their ideas as the terrestrial poles. But just as the two poles have been brought relatively close together by man's conquest of the air, so has the disturbing effect of the intensive production forced by the World War brought about a revolution in the relations between these two schools of industrial thought. An article by Paul Devinat in the April issue of the "International Labor Review," and reprinted by the International Labor Office of the League of Nations, points out the new relations that are developing between labor and scientific management in the United States and indicates the interest with which Europeans are watching this development.

Perhaps the most spectacular example of the dawning recognition by labor that scientific management is a good thing is the experiment in certain railroad shops. It is by no means the only example but it has certainly attracted more attention than the others. No one knows how any of these ventures will work out but certainly they evidence a budding spirit of co-operation that is much more promising for the future of American industry than the old attitude of uncompromising hostility. It is probably not too much to say that co-operation of this sort is vitally necessary if American business is to hold its own with foreign competition and still maintain American standards of living for the wage earner.

Standardization Without Ruts

THE worst enemy of standardization is the man who considers any standard in any line as the last word and uses it as an alibi for not investigating the desirability of new and better methods. It is, however, a great mistake to condemn efforts at standardization on that account. The desirabliity of having parts interchange, of knowing that a Class 1 fit would be the same in all parts of the country, or that designations of quality meant the same in all cases, can hardly be overestimated.

There is unquestionably a tendency to stick to standards after they have been adopted, and this of itself is an advantage in many ways. But no one should consider either standards or codes as the last word. Both should be criticised constructively and, when sufficient reason for change is presented, amendments or even drastic changes should be made.

The Society of Automotive Engineers has adopted many standards and these have helped to make possible the improved quality and lower prices of automobiles. Yet these standards are constantly under examination, and revisions are made whenever it seems advisable. As an example of standardization without getting into ruts, the automotive industry is a shining example.

A salesman should know his line thoroughly. There is nothing more injurious to a salesman than for him to say, "I don't know."

American Industry and Taxation

By James A. Emery
General Counsel National Association of Manufacturers

Tremendous increase in taxation since the outbreak of the World War—Federal taxes less but other taxes much greater—The responsibility of industry

AMERICAN industrial development is intimately related to American taxation. The greatest evil of disproportionate and extravagant public expenditure is that it takes from a people too great a share of that surplus which constitutes the sole fund out of which to expand and develop their individual and social life.

Prior to the World War our taxes were negligible. Then within a brief period we hastily erected a collecting structure which took in revenue and left in debt a sum in excess of the total cost of American government from its birth to our entrance into the tragic struggle. The war cost us forty billion dollars, a sum equal to the total net earning power of the manufacturing corporations of the United States over a ten-year period. We raised that colossal sum partly by loans from our people and partly by direct taxation. We now face an annual debt of substantially twenty billion dollars which we are retiring at the rate of a billion a year. The interest upon this requires 40 per cent of federal revenue, but federal taxes have now fallen to about $3,250,000,000 for the current fiscal year, with a promise of further reduction.

But we are citizens of the states as well as the nation. We support state, county, municipal and smaller units of local government. Our tax bill is the current expense and the interest upon the debt of all these forms of government. Neither may tax the securities emitted by the other, and each may exempt its own paper from any form of levy.

The Expense of Government

The taxpayer is therefore meeting, in addition to the requirements of interest and sinking-fund charges upon $20,000,000,000 of national debt, similar charges upon $1,558,000,000 of state bonds and $10,000,000,000 of city, county and other local indebtedness. While the tax requirements of federal government have fallen from substantially $6,000,000,000 to approximately $3,000,000,000 per year, the sums required for the current operation of state government have increased from $570,000,000 in 1919 to $1,064,000,000 in 1924, while city and local taxes have increased from annual demands for $2,395,000,000 in 1919 to substantially $4,000,000,000 in 1925. The total of federal, state and local taxes now aggregates $8,000,000,000 annually. Their total expenditure, made up of revenues from other sources and the proceeds of loans which represent deferred taxation, approximates $10,000,000,000. The indebtedness of state and local government is rising at the rate of a billion a year, which equals the annual reduction of the national debt, while the current taxation of the states and localities has risen annually in excess of the reductions in taxation made by the national government.

What do these figures signify? They mean that our state and local indebtedness is greater than the annual value of the crops raised upon the six and a half million American farms. They mean that the net income of the manufacturing corporations of the United States does not provide the funds required for state and local government, nor would that be met by all the money in circulation in the United States.

The Illusion of Taxation

The great volume of federal revenue is obtained from individual and corporate income, while more than 90 per cent of state and local taxes fall upon real property. Substantially 7½ per cent of our population makes an income tax return, and about 3½ per cent have been paying an income tax. But does this mean that a handful of our people or our business organizations pay the cost of government, that many sit at the public table but a few sign the check? Such a delusion undoubtedly exists. Indeed, the constant demand for new and expensive services from government indicates a widespread belief that all may enjoy its benefits and a few may be made to carry the expense. It is an amazing illusion, for taxation is our social overhead. It represents the cost of living under organized government. It is as much of a fixed charge as any other element of cost in production or service and is unavoidable. It is written into food, clothing, shelter, light, heat distribution, communication, every commodity sold and every service performed.

And yet we approach the taxpayer with a bill in one hand and a tax-exempt security in the other, while lifting the rate to possessors of large income to a point where it is more profitable to permit capital to loaf in a place of refuge from public burdens than accept, without hope of proportionate return, the risks of business investment. This has been the cardinal sin of our system.

But the industrial system we have established and developed and the maintenance of our prevailing standards of life consume for their support an increasing amount of all we produce. To conserve our producing power is our first task. To increase our surplus that we may have proportionate means to renew our economic machine, conduct experiment, enlarge established enterprise and develop new processes and the means of meeting ever-increasing wants and a steadily enlarging population is the price of progress.

What, then, is our taxable capacity? Government,

national, state and local, is consuming annually 12 per cent of the total national income. That would mean that for six weeks every year the nation labored exclusively for the state. That in itself is startling, but it understates the fact, for probably three-fourths of the national income is consumed in sustaining the commodities and services which represent that resultant. Taxes, however, are not paid from gross income. They are the first charge against the net result. They are a necessary limitation upon what we may otherwise spend or save.

Taxes are a compulsory, not a voluntary contribution. It is only what is left after we consume to sustain our individual and economic life that is available for betterment. It is not the product of the farmer's fields which measure his prosperity; it is what is left after expenses are met and taxes are paid which permits him to renew or increase his tools, enlarge his acreage, improve his stock, repair his buildings and put something aside for sickness, old age and enlarged opportunities for his children. It is what is left after operating expenses are met which permits a railroad to enlarge its facilities and improve its service. It is not the $48,000,000,000 which measures the progress of the 63 per cent of manufacturing corporations that alone show a net income, but the $4,250,000,000 of profit which gives them the means of sustaining and expanding the service they render to the American people. What is true of the individual or of business is true of the nation. It moves forward only through the savings of self-denial and thrift, with the aid of those margins above our individual or collective consumption.

Production and Consumption

Our taxable capacity as a people, then, is not the difference between that 12 per cent we expend for government and the value of our gross production of commodities and services. It is the difference between what we produce and what we consume. It is the sum we may safely take from that average 25 per cent of surplus without imperiling the size and stability of that fund through which we meet the requirements and provide the improvements of our future. It is time to reflect upon the stunning fact, not that government demands one-eighth of our income, but that it is absorbing perhaps one-half of our surplus.

The remedy for our condition is both individual and collective. We need to establish a tax consciousness which will make each citizen feel the nature and extent of our public burdens and their effect upon the conservation and expansion of our life. We must face the obligation to draw the line between parsimony and extravagance in public expenditure. We must provide not merely budgetary safeguards to the smallest taxing unit and enforce them, but we may profit by the successful experiment introduced by the Governor of Minnesota requiring administrative officials to justify to a qualified administrative control the actual expenditure of appropriated money. We must lessen the demand upon government for new services and aids.

The Secretary of Commerce has enumerated and described 200 bureaus, boards and commissions operating within the federal government without any system of organized relationship. A similar condition undoubtedly exists in many of our state, municipal and county organizations. They present a fruitful field for practical reorganization which can be effected only by the people of each state and community in terms of their own knowledge of local requirements and conditions. The hour is ripe, not merely for the reduction of rates, but for the intelligent reconstruction of our taxing system, and since American industry provides so great a share of the money there rests upon the industrial executive a responsibility for initiative and leadership in effecting this reform.

Experimental Work in the Shop

By Entropy

Jim is peeved. He says I keep telling the readers of the *American Machinist* all about his troubles and shortcomings, but I don't say anything about my own. He threatened to write something about me, but he didn't, so I got him to tell me what he would write, and here it is:

"In the first place you preach all about planning out work, but I notice that with most of the jobs you take on, you haven't the least idea of what you are actually going to do until you come to it. Anyone would think that you sat up nights and stayed away from church Sundays to plan out every move you make, but I come over here and find you running an experimental shop.

"There's that stamping job that you were going to get out last week. You got all rigged up with a kick press, and were going to have them all kicked out by Wednesday night, but on Thursday you had the whole job over by the drop press, and you were slamming away. Now I know what you were up against. You found your steel was harder than you thought it was, and it didn't stay pressed, so you go and hit it a clip and it stays set, where you want it.

"Then there was that job on that copper tubing that had to be ground to size. Every time you ran over it, it curved a different way. Looked a good deal like a fishworm when you got through. It was lucky your customer came around and didn't care whether it was ground or not. Then you had a job in here last month, that bed plate you undertook to plane up for Grogan. The drawing called for a width of 48½ in., and your 48-in. planer is 49 in. between posts. When you got the casting into the shop it was swelled, and there was so much finish that you tipped the thing up about 20 deg. and hogged off the extra metal before you could lay it down flat and plane it."

Every Job an Adventure

Well, of course, there is no answer to Jim except to say that there is more fun in doing these things that don't come out just the way we expect than there is in doing the things that we know exactly how to handle. There is, however, quite a little discrepancy between running a shop and operating a shop scientifically. If any one can reduce his work to a science, most anyone can run his shop for him and make it pay, but it takes resourcefulness to run a shop where every new job is an adventure into the unknown.

Scientific management implies a research laboratory, or else turning the shop into one. I believe it was Chordal who advised that if you were going to do any high-and-mighty experimental work in the shop you should do in on the other side of a brick partition with no doors. The advice is just as good now as then.

Shop Equipment News

Rockford Universal Open Side Shapers 26- and 36-Inch

The open side shaper shown in the accompanying illlustration is built in two sizes having strokes of 26 and 36 in., by the Rockford Machine Tool Co., Rockford, Ill., for work that cannot be handled accurately on the standard crank shaper. Ball bearings are used throughout.

The machines are equipped for either individual motor or single pulley drive. The columns are planed with pads on which motors can be mounted, in case it is desired to change from the pulley to the motor drive.

The shaper is controlled by means of a lever to a friction clutch and brake. The same form of rocker-arm mechanism employed in the standard Rockford crank shaper, previously described on page 331, Vol. 63 of the *American Machinist*, has been included in the design of the open side machine.

Eight changes of stroke speed can be obtained through sliding gears mounted within the column. On the 26-in. machine these changes cover a range of from 9 to 50, and on the 36-in. machine, of from 6½ to 33 strokes per min. The sliding gears are controlled by means of three handles which can be seen near the housing that contains the clutch and the driving gear. The handles are pushed in or pulled out, as required, to engage pairs of gears. The levers are located by means of spring plungers which enter pockets in the push rods.

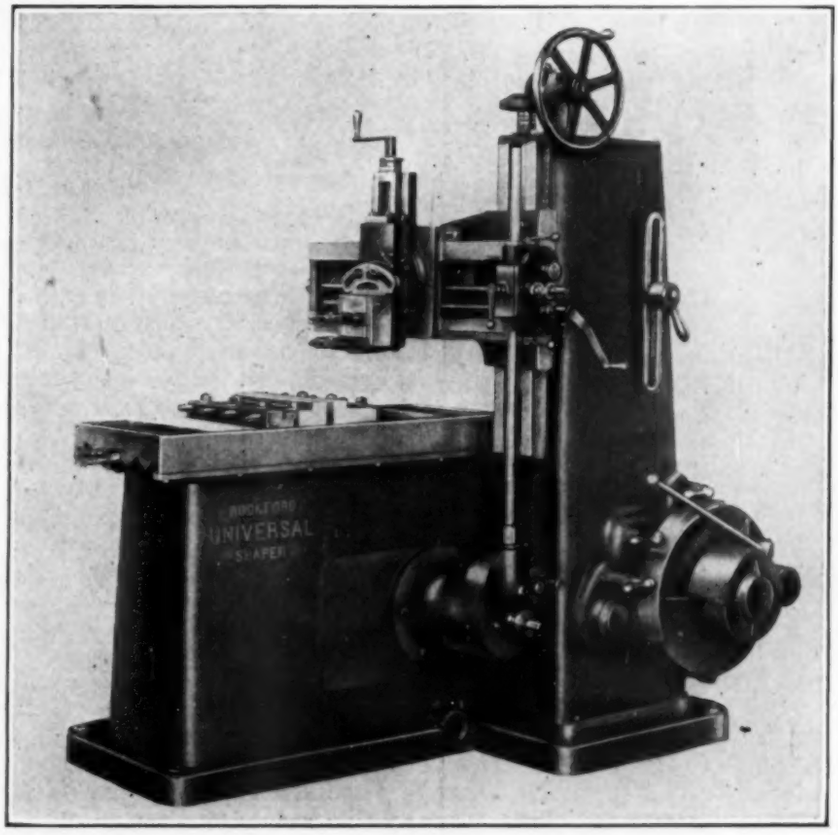
The two sizes of machines are similar in design, but the 36-in. machine can be equipped with a side head. The 36-in. machine also has a special mechanism for the table movement because of the length of the stroke. The mechanism consists of two opposed racks, one of which is secured to the under side of the table and the other is fixed in the bed of the machine. Between these racks and meshing with each of them is a pinion carried on a shaft that is connected with the rocker arm by means of a link. As the rocker arm moves back and forth the pinion drives the table to double the stroke that would be secured if the arm were linked directly to the table.

On both the machines provision is made for positioning the stroke so that it will be convenient for the work. This is accomplished by means of an adjusting screw at the end of the table. With the 26-in. machine a block to which the power link is connected, is secured to the under side of the table between V-bearings and a tapered gib. Similarly, on the 36-in. machine the rack is secured to the under side of the table by the same method. After releasing the block or rack, the table is adjusted to bring it to the required position. The block on the rack is then resecured to the table.

Provision is made for the lubrication of the bearings by means of a perforated oil tube which runs through the table over each bearing. Felt wipers are inserted in slots opposite the openings in the oil tubes and the lubricant is distributed through the wipers over the bearings. The surplus oil runs down through the holes at the end of the V's into a reservoir in the base of the machine.

The open side shaper is furnished with the same type of feed mechanism as that used on the standard crank shapers manufactured by the company. The mechanism is of the ratchet and pawl type. There are eleven horizontal and vertical power feeds available on both sizes and these range from 0.008 to 0.088 in. per stroke.

At the right-hand end of the cross-rail can be seen three small levers,



Rockford Universal Open Side Shaper

Shop Equipment News

one at the top, one at the bottom and one at the front. The top lever engages the vertical feed and the one at the bottom engages the horizontal feed. The lever at the front is thrown into engagement next and it controls the direction of the feed. Hand feed can be secured by means of a crank at the end of the feed screws. Vertical adjustment of the cross-rail on the column is secured only by hand through the large handwheel at the top of the column.

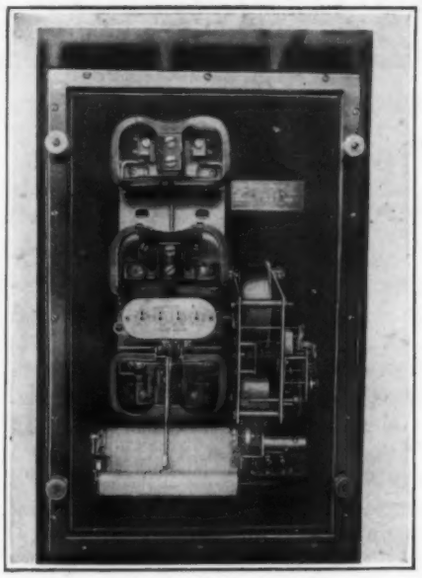
To assure rigidity of the cross-rail, its cross-section is of the box type. The bearing of the rail on the column has a length three times the width of the bearing. The rail is clamped by tightening bolts at the top and at the bottom of the rail and a binder which secures the rear bearing to the column.

The 26-in. machine provides for a horizontal travel of the tool of 23 in. The vertical travel of the tool is 9 in. The maximum distance from the table to the cross-rail is 16 in. The working surface of the table is 18x38 in. and the table adjustment is 12 in. The height of the machine from the floor to the table is 36 in. A 7½-hp., 1,800-r.p.m. motor is required to drive the machine. The shaper weighs about 6,000 lb., without the motor.

The horizontal travel of the tool on the 36-in. machine is 30 in. and the vertical travel is 9 in. The maximum distance from the table to the cross-rail is 24 in. The working surface of the table is 21x44 in. A table adjustment of 12 in. is provided. The height of the machine from the floor to the table is 36 in. A 10-hp., 1,800-r.p.m., motor is recommended for the machine. The weight of the shaper without the motor is about 7,200 pounds.

Westinghouse Three-Element Demand Meter Type RA

The three-element demand meter, type RA, illustrated, is being marketed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., for use with 3-phase, 4-wire circuits. Three elements are necessary to correctly meter such 4-wire circuits under unbalanced voltage or load conditions in accordance with Blondel's rule that states that in order to measure a circuit of n wires, one must use $(n - 1)$ wattmeter elements.



Westinghouse Three-Element Demand Meter Type RA

The meter is similar to the standard RA and OA 2-element house and switchboard meters, except that it possesses an additional metering element and disk shown at the top of the cabinet.

"White" Compression-Loss Micrometer

An instrument for measuring compression leaks in internal combustion engines is being marketed by the Leak Micrometer Corporation, 1068 Mission St., San Francisco, Cal., under the name of the "White" compression-loss micrometer. It is shown in the accompanying illustration.

The principle of operation involves the measuring of the flow of air at a predetermined pressure through any leaks that may exist in a cylinder block assembly. The valve and the piston leakage can be measured independently. The instrument is connected to a source of air supply that is reduced by a valve to a constant pressure of 75 lb. per sq.in. Any service air line carrying a pressure of 90 to 150 lb. per sq.in. can be used. An outlet hose is connected by means of a special plug to the cylinder being tested and the air flowing through the leaks is passed through an orifice of known area. The drop in pressure is read on a gage.

To use the instrument, the spark plug is removed from the cylinder and the special plug with its hose connection is inserted. It is first necessary to ascertain that the valves are closed. This is done by placing a signal whistle on the instrument where the air supply would otherwise go, and turning the motor slowly by hand until the whistle sounds. This indicates that the piston is beginning its compression stroke and that both the inlet and exhaust valves are closed. The motor is locked in this position by setting the transmission in gear and by applying the emergency brake in order to prevent the motor from turning when the testing pressure is applied. The signal whistle is then removed and the air supply is connected. The calibrating valve is manipulated until the right-hand dial reads zero, at which time the reading of the left-hand dial is noted. This reading is the total leakage.

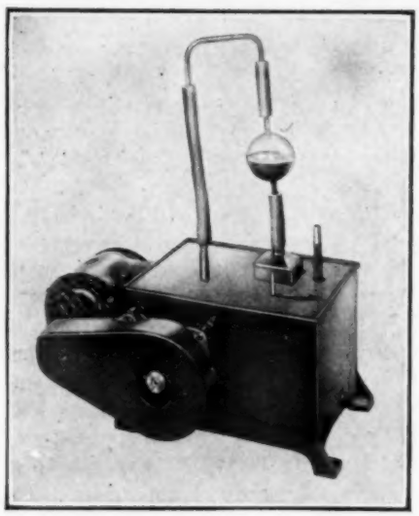
To measure the valve leakage a quantity of heavy cylinder oil is placed on top of the piston to seal it against leakage. The piston leakage is determined by subtracting the valve leakage from the total. The presence of scores or other imperfections on the cylinder walls can be detected by taking readings at different positions of the piston. If the cylinder is perfect, all the readings will check. Leaks in the instrument's hose can also be detected.

"White" Compression-Loss Micrometer

Shop Equipment News

Eisler Combination Vacuum Pump

The combination vacuum pump shown in the accompanying illustration has been placed on the market by the Eisler Engineering Co., Inc., 756 South Thirteenth St., Newark, N. J., and is intended for radio tube and lamp exhausting or for purposes



Eisler Combination Vacuum Pump

where a high vacuum is necessary. It is oil sealed, the level of the oil being above all the moving parts. The viscosity of the oil aids in sealing the pump from the atmosphere.

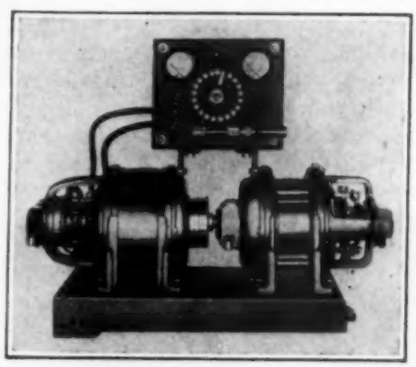
The principles of operation of the pump are similar to those for the "Midget" high-vacuum pump previously described on page 657, Vol. 64, of the *American Machinist*. The pump, of the compound type, is connected with an oil trap and tubing as shown. The tube to the left can be connected to whatever is to be exhausted, with a pinch cock in its line. The right-hand tube is also connected to the exhausting manifold with a pinch cock. After the pump is started the right-hand pinch cock is closed and the other is opened. Pump No. 2 is the compound pump which does the preliminary exhausting. After a few minutes the right-hand pinch cock is opened and the other is closed. The single-stage pump, No. 1 is the finishing pump, and pump No. 2 acts as the backer to the former when exhausting. The rod projecting through the slot at the right-hand end of the cover is a shut-off valve in the corner tube.

It is claimed that a vacuum reading of 0.00015 mm. on a McLeod gage can be secured and that a break of the vacuum will not injure the machine nor necessitate its adjustment. The pump can be had for belt drive or it can be mounted, as illustrated, as a unit with a ½-hp., 500-r.p.m. motor. It occupies a floor space of 14x16 in. and stands 12 in. high. The pulley-driven pump weighs 175 pounds.

Weidenhoff Constant-Potential Battery Charger

Four sizes of constant-potential battery chargers have been placed on the market by Joseph Weidenhoff, 4352 West Roosevelt Rd., Chicago, Ill. One of the models is shown in the accompanying illustration.

The motor and generator are both mounted on a single base with the panel. The arrangement permits the use of a solid coupling between



Weidenhoff Constant-Potential Battery Charger

the motor and the generator. Standard sleeve bearings are used and the armature can oscillate. A three-bearing construction has been adopted.

Its compensating-pole design is claimed to keep the voltage constant under all load conditions from no load up to 25 per cent overload within a fraction of $\frac{1}{10}$ of a volt. The generator has a laminated field frame and the brushes are designed with a minimum of brush surface. The unit is non-reversible and can be operated on a battery line when the power fails.

The model No. 50 unit has a 100-amp., 7½-volt generator direct-connected to a 1½-hp. motor and a 10-circuit, 3-bus bar charging panel. The model No. 55 is for 100-amp., 15-volt, or for 200-amp., 7½-volt, service. It has two 100-amp., 7½-volt generators, connected on each end to a 3-hp. motor. A 20-circuit, 3-bus bar charging panel is furnished. A similar panel is supplied with the model No. 60 unit which has a 200-amp. 7½-volt generator direct-connected to a 3-hp. motor. The model No. 65 machine is for 400-amp., 7½-volt, or for 200-amp., 15-volt, service. Two 200-amp., 7½-volt generators are direct-connected to a 5-hp. motor. The unit is equipped with a 40-curcuit, 3-bus bar panel.

Ryerson Portable Corrugated-Sheet Shear

The portable shear illustrated is for the straight or curve cutting of corrugated sheets without distortion. It is being manufactured by Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill. After the cut is started, no effort is required to feed the shear into the work.

The cutting is accomplished by means of a pair of rotary double-edged cutters, knurled around the shearing edges. The upper cutter is driven by an internal ratchet which is operated by the handles. The lower cutter runs free. The driven cutter is adjustable by means of a

Ryerson Portable Corrugated Sheet Shear

capscrew so as to assure a continuous, even feed on all sheets within its capacity, which is up to 20 gage.

The tool can be withdrawn from the sheet at any point by loosening the adjusting screw on the upper cutter.

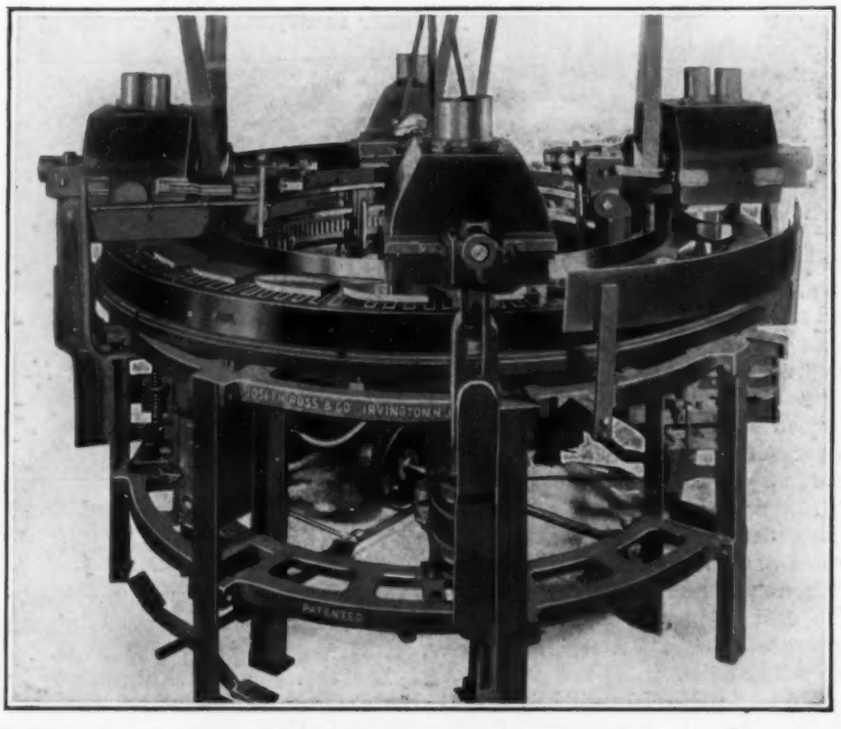
Shop Equipment News

Ross Continuous Surface Grinding Machine

In order to secure a continuous operation in surface grinding, Joseph Ross & Co., Irvington, N. J., have designed and built the machine illustrated herewith. The work is carried under several grinding heads by special Walker magnetic chucks mounted on an annular table that passes under as many grinding heads as the work demands, four being used on the flat-iron bottoms shown. In this way the work can be divided into as many stages as necessary, the last grinding head producing the desired finish.

The magnetic chucks are independent of each other and are connected to suitable contacts so that current can be thrown off when the loading point is reached. The annular table is driven by an internal gear through the pinion shown at the left, from a motor in the center. In the machine shown, the grinding heads are belt driven but motors can be mounted on each head if desired. Wheels can be of any width or grade to suit the work.

The rotary grinding head rests on rollers and can be made to accommodate the work in hand. The machine shown is 75 in. in diameter. The table is 12 in. wide and it occupies a space 8 ft. square. It weighs 2,500 lb. On some work one or more of the grinding wheels are omitted and brush or rag polishing wheels substituted. Work not requiring a high finish can be fed at two or four points, increasing the output but requiring an operator at each point to feed and unload the work.



Ross Continuous Surface Grinding Machine

"Storm" Cylinder-Boring Machine, Model F

The Storm Manufacturing Co., Inc., Minneapolis, Minn., has brought out a machine for garage use for reboring automobile cylinder blocks. The "Model F" machine, shown in the accompanying illustration, is designed especially for Ford and Fordson cylinders.

The machine has a heavy cast-iron base upon which the cylinder is located from the same holes as used at the factory. The boring bar is held in two adjustable bearings, and is of hardened steel. It is claimed that the rebored cylinders will be in perfect alignment with the crankshaft, and identical in size.

The cylinders are machined and bored at one setting. The feed is automatic, and a stop switch is provided which stops the motor when the cutter-head reaches the end of the cylinder. The cutter-head has six spiral cutters, set in opposed positions to equalize the cutting strains. It is adjustable for all oversizes of the cylinders. The cutters have two edges, one for roughing, and one for finishing.

"Storm" Cylinder-Boring Machine

The cylinder-boring machine is driven by a ¼-hp., 110-volt, motor, furnished either for direct or alternating current. The machine occupies a floor space of 20x32 in. and weighs 325 pounds.

Silberberg Master Chronograph

The Mortimer J. Silberberg Co., Inc., 116 South Michigan Ave., Chicago, Ill., has placed on the market an improved model of the Master chronograph that is intended for use in connection with industrial work, observations and investigations.

The instrument illustrated has been designed for heavy service embodying larger pinions, stronger cam construction and larger jewel bearings than were used heretofore. The production figures have been carried out to include two minutes of observation whereas the former dial design embraced only one minute. The case is furnished gold filled.

The instrument embodies an accurate timepiece of fifteen jewels,

Shop Equipment News

Silberberg Master Chronograph

with a chronographic indicator that operates in seconds and fifth-seconds. A small dial registers time measurements up to thirty minutes.

Lapointe Special Broaching Machine, No. 2

The Lapointe Machine Tool Co., Hudson, Mass., has brought out a special short-stroke broaching machine for small work, such as round holes and small keyways. The features of the machine are simplicity and compactness. The No. 2 special broaching machine occupies about 6 ft. less floor space than that required for the regular machine.

It will broach keyways $\frac{1}{4}$x$\frac{1}{4}$x2$\frac{1}{2}$ in. in steel, round holes up to 1$\frac{1}{4}$ in. in diam. and square holes $\frac{1}{2}$x$\frac{1}{2}$x2$\frac{1}{2}$. The draw bar is screw driven. The screw is about 2 in. in diam. and is fitted with a bronze nut 7 in. long. The length of the stroke is 24 inches.

The driving pulley is 14 in. in diam. and has a 4-in. face. It operates at about 600 r.p.m. Cutting speeds of 48, 72, 96 and 120 in. per min. can be obtained. The return of the draw bar is at approximately 3$\frac{1}{2}$ times the cutting speed.

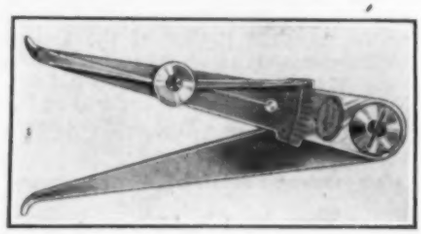
The faceplate has a hole 5 in. in diam. There is a vertical adjustment to the draw head ranging from 1 in. below to 1$\frac{1}{2}$ in. above the center of the hole in the faceplate. The machine is furnished with an oil pump, drip pan, screw guard, and with one full bushing and one reducing bushing.

The floor space occupied is 114x20 in., this space allowing for the screw guard and drip pan. The net weight is about 1,250 pounds.

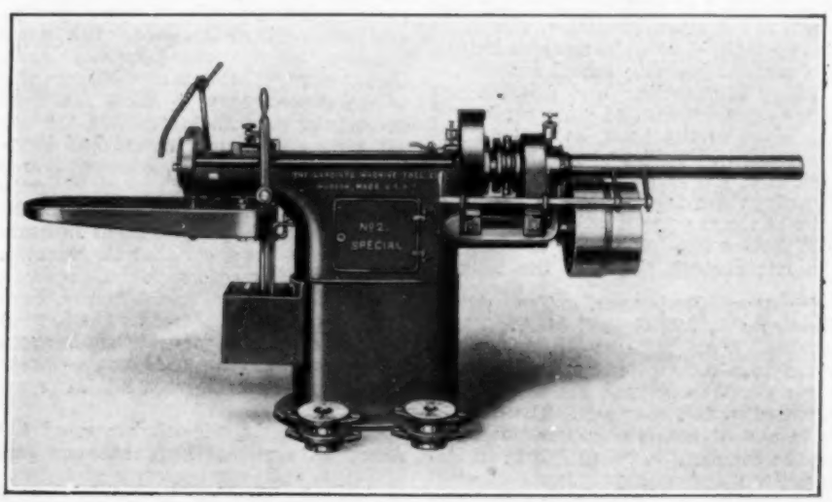
A similar machine, the No. 3 special, is made to the same specifications in every respect, except that in this case the stroke is 20 in. The No. 3 machine has the same pulling power as the No. 2, and it is recommended especially for broaching ring gears and similar work.

"Grove" Indicating Gage

The "Grove" indicating gage has been brought out by J. M. Waterston, 427 Woodward Ave., Detroit, Mich. The gage, which is shown in the accompanying illustration, is designed for the accurate measurement of internal surfaces. The tool is not a caliper, but is claimed to be a smooth working indicator gage for accurate toolmaking work. Its measuring capacity is from $\frac{1}{4}$ to 4 in. All parts are finished all over, and are hardened where subject to wear.



"Grove" Indicating Gage



Lapointe Special Broaching Machine, No. 2

Pamphlets Received

Empire Markets, No. 1. Australia. Prepared and published by the Dorland Agency, Ltd., 14 Regent St., London, S.W., England. Sixteen, 5x7$\frac{1}{2}$-in., pages. This pamphlet is the first of a series on the markets of the British Empire and gives statistics of interest to those engaged in foreign trade, as well as comments on different phases of the country. The people and population, occupations, land holdings, savings, wages, trade unions, unemployment, trade and commerce, railway traffic and shipping, foreign trade, and finance are the titles of the sections in the pamphlet.

Employee Magazines. Report No. 74 of the Policyholders' Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y. This report, containing twenty, 8$\frac{1}{2}$x10$\frac{1}{2}$-in. pages, will be found a valuable aid to those interested in or engaged in the publishing of employee magazines. The pamphlet discusses the purpose of the employee magazine, its preparation and publication, as well as methods of handling the material.

The pamphlet itself is well prepared and executed, and will be found very interesting.

Flow of Heat in Pistons. By H. A. Huebotter and G. A. Young. Bulletin No. 25 of the Engineering Experiment Station, published by Purdue University, La Fayette, Ind. The purpose of this bulletin is to establish the optimum distribution of metal in the trunk type piston, for thermal conductivity from the head to the cylinder wall. In the investigation two methods have been employed. These are the mathematical analysis for the comparison of various head and barrel sections and also laboratory experiments for the study of the relative rates of heat emission from the ring belt and from the skirt. The bulletin contains one hundred and twenty, 6x9-in., pages and is illustrated with drawings and graphs.

Strain Lines Developed by Compressive Tests on Structural Members of the Delaware River Bridge. The Bureau of Standards has published a chart and a technologic paper by R. S. Johnston on the strain lines developed by compressive tests on structural members of the Delaware River Bridge at the United States Bureau of Standards for the Delaware River Bridge Commission. Two photographs are reproduced of the lines as brought out by the cement method.

Trade Catalogs

Bearings, Ball Thrust. The Standard Steel and Bearings, Inc., Plainville, Conn., is issuing a series of data sheets, 4½x7½ in., for loose-leaf binding, on its M-R-C thrust bearings. These include both the single-acting and double-acting types. The sheets contain specifications for the bearings, sectional line drawings of the various models and photographs. The sheets can be used in S.A.E. binders.

Breakers, Circuit. The Roller-Smith Co., 233 Broadway, New York, N. Y., has published a supplement to its Bulletin No. 530, to cover its direct-acting, time-limit, attachments for "Standard" type circuit breakers. The bulletin contains a description, photograph and line drawing of the attachment.

Chucks and Vises. The Skinner Chuck Co., New Britain, Conn. Catalog No. 40-C is a condensed bulletin on the lathe, drill and planer chucks and vises manufactured by this company. The products are briefly described and are illustrated. Specifications are given of the sizes in which they can be obtained.

Condensors, Static. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Leaflet 20286 describes static condensers for power-factor correction on motor circuits of 220, 440 and 550 volts. The application, construction and installation features of this type of condenser are discussed, as well as the advantages of power-factor correction at the motor. A table giving the corrective kva. for various ratings of 3-phase, 60-cycle, type CS, squirrel-cage, induction motors for horsepowers of from ½ to 200, is included in the leaflet.

Dilatometer. The Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn., has published Bulletin No. 2605 on the Rockwell dilatometer for "Volcrit" heat-treating. The operation of the machine is briefly described as well as the advantages of the system of heat-treatment.

Filters, Air. Drying Systems, Inc., 1800 Foster Ave., Chicago, Ill. A folder has been issued by this company illustrating and briefly describing the principles of operation of the Phoenix constant-efficiency air filter which is electrically operated.

Grinding Machines. The Norton Co., Worcester, Mass., has published a booklet, containing twenty-four, 5x7-in., pages, entitled "Grinding in the Railroad Repair Shops." The booklet describes various machines adaptable to railroad repair shop service and others that are specially designed for this work. The machines are illustrated and briefly described and machine data are given showing typical jobs on which the machines can be used. The catalog is well prepared and follows the general design of the usual Norton booklets.

Heating Units, Electric. The General Electric Co., Schenectady, N. Y., has issued its circular GEA-380, on G-E helical sheath wire units, consisting of a heating element of nickel-chromium wire in the form of a helix surrounded by a dense, highly compacted insulating powder and inclosed in a sheath or casing cast into various forms of plates. Several models are illustrated.

Machine Tools. St. Louis Machine Tool Co., St. Louis, Mo. Catalog No. 17 describes the grinding and polishing machines, tapping machines and chucks, countershafts, and saw tables manufactured by this company. The catalog is bound in a loose-leaf cover 8½x11 in. in size. Illustrations are given of the various products included in the catalog. Specifications and brief descriptions of all the machines are also given.

Motors, Electric. The Master Electric Co., Linden and Master Aves., Dayton, Ohio. "Brass Tacks about Small Motors," is the title of a small and concise booklet published by this company to point out the various considerations to be taken account of in the purchase of fractional horsepower motors. It is an interesting analysis arranged in the form of fifteen questions and answers.

Pyrometers. The Brown Instrument Co., 4501 Wayne Ave., Philadelphia, Pa., has published a circular entitled "Back of Marmon Dependability and Ruggedness." The circular contains illustrations and a description of the Brown installations at the Marmon plant and describes some of the details of construction of the instruments.

Saws and Knives. E. C. Atkins & Co., Indianapolis, Ind., have published the second edition of their Catalog No. 19, which contains two hundred and sixty-four, 7x10-in., pages. The catalog is attractively prepared and covers an imposing line of products including mill saws, metal saws, hardware, saw tools and specialties, trowels, machine knives, and manual training school supplies.

Many illustrations and detail views of the saws, knives and other equipment are given in the book, as well as full descriptions. Tables show the specifications of the various sizes and models. Drawings are freely used to show details of the saw teeth and of the knives. The Atkins five-letter code is given on the introductory pages of the book.

Starters, Resistance. The Allen-Bradley Co., 286 Greenfield Ave., Milwaukee, Wis. Bulletin No. 600 is devoted to a description of the alternating-current resistance starters manufactured by this company. The bulletin is in accord with the others published by the company in being full in its descriptions and well prepared. Several photographs and graphs are included with the text. The bulletin discusses the squirrel-cage induction motor and its characteristics, starters for squirrel-cage motors and their purpose, line surges of the starting compensator and the prevention of surges by the compression resistance starter.

Tapping Machine. The Hart & Hegeman Manufacturing Co., Hartford, Conn., has published a circular describing in considerable detail its high-speed automatic tapping machine. Detail photographs illustrate the spindle, knockout and indexing mechanisms as well as other parts.

Ties, Steel Track. Bethlehem Steel Co., Bethlehem, Pa. Bulletin No. 31-A describes the Bethlehem steel ties for mines and industrial track. It contains thirty-four 9x6-in. pages devoted to applications of the equipment and including many photographs of the use of and installation of the ties. Line drawings and tables show the specifications of the sizes in which they may be had.

Ventilators. The Aircraft Manufacturing Co., Dayton, Ohio, has issued a circular describing the "Fan-O-Plane," air-plane-type, fan for room ventilation purposes.

Welding and Cutting Equipment. Torchweld Equipment Co., Chicago, Ill. Catalog No. 23 describes the portable and stationary plants manufactured by this company for oxy-acetylene welding and cutting, leadwelding, brazing, soldering and decarbonizing. Bound with the catalog in a loose-leaf cover is the company's price list No. 37. The catalog describes and illustrates many welding and cutting outfits as well as fittings and accessories for the apparatus. The catalog contains forty, 8½x11-in. pages.

International Standards on Ball Bearings

Representatives of Sweden, Germany, Russia, Japan, Czecho-Slovakia and the United States, who were in attendance at the recent conference on ball bearings, discussed proposals for internationally standard ball bearings advanced at earlier conferences in Zurich, Switzerland. The Zurich proposals on radial ball bearings have met with general approval in America, with some relatively unimportant differences as to the amount of the tolerances or size variation necessary to allow for inaccuracies of manufacture.

On the question of thrust ball bearings in millimeter sizes, however, it was not possible to arrive at so satisfactory a consensus, as European practice in the use of thrust bearings differs in quite important ways from that in America. American suggestions for changes in the European proposals, however, have been carefully considered by the foreign experts, and new proposals are in preparation on which there is a fair chance of obtaining an agreement at some later time.

C. M. Manly, vice-chairman of the American sectional committee on ball bearings, and representative of the Society of Automotive Engineers on the A.E.S.C., presided at the meeting.

News of the Week

Railway Executives and Supply Men Hold Convention at Atlantic City

Master mechanics given credit for great improvement in efficiency of American locomotives and equipment

All previous records of exhibition entries and attendance were broken at the annual convention of the American Railway Association and the Railway Supply Manufacturers' Association at Atlantic City, June 9 to 16. Besides the customary space occupied by exhibitors on the Million Dollar Pier the new structure on the opposite side of the boardwalk was enlarged and turned over entirely to machinery exhibits and designated as Machinery Hall. Another canvas covered space, 150 ft.x180 ft., between the railway sidings in Mississippi and Georgia Avenues, was occupied by the Motor Transport Exhibit. The total exhibit space occupied was 145,600 sq.ft., which was an increase of 40 per cent over the enlarged space of two years ago. The total exhibitors reached over 400, while first day registrations reached 4,105, an increase in attendance of 35 per cent over that of two years ago.

The new chairman for the term expiring June, 1927, is L. K. Sillcox, general superintendent of motive power, Chicago, Milwaukee & St. Paul; and the vice-chairman is G. E. Smart, chief of car equipment, Canadian National.

Purchaser Is Important

"A vast responsibility rests upon railroad men who purchase more than a billion dollars worth of supplies annually," Elisha Lee, vice-president in charge of operations of the Pennsylvania Railroad, told the delegates at the Thursday morning session. Mr. Lee further stated that "at no time in the history of the railroads have executive officers generally attached more importance to the purchase, storing, and distribution of materials than at present," and that "the prosperity of the country is closely allied to the buying policies of the railroads."

In addressing the opening sessions R. H. Aishton, president of the American Railway Association, said in part: "In the past seven years we have traveled far. Everybody then was dissatisfied and discouraged. Since that time we have seen a wonderful improvement take place, not only in the conditions of the railroads, but more particularly in the attitude of public opinion towards them." He went on to say that part of this change was brought about by "the courage of the railroad managements in the vast expenditures made for improving plant, amounting in the aggregate to about $4,000,000,000 of additional capital in the last few years."

The feature address of the first day's sessions was that of Samuel M. Vauclain, president of the Baldwin Locomotive Works. Mr. Vauclain praised the work of the association, and said that in his judgment the Master Mechanics' Association has had more to do with the advance in the art of locomotive building than any other agency. He spoke interestingly of his recent tour of inspection in Europe, and told how the countries of that continent were far behind America in railroad equipment of all kinds. He said that the prosperity of the United States is largely due to the tireless energy of the transportation people in making it possible for the hundred million people to communicate with each other in a short space of time.

Chairman J. T. Wallis, who last year attended the meetings of the International Railway Congress, spoke of what he saw in Europe, and made some interesting comparisons. Among other things he said: "When I traveled in England and France and saw the multiplicity of design of equipment, where we have one pattern, I realized the priceless thing the Master Car Builders' Association did when it made standardization in essential things compulsory." Mr. Wallis showed how the Pennsylvania Railroad in this country with only 7,000 locomotives had earnings close to those of the four English systems with about 24,000 locomotives.

Shop Committee Reports

The committee on shops and engine terminals presented a report on freight car repair plants with plans for a modern car repair shop with standing capacity for 45 cars. The committee in submitting its report stated that it now considers that about 70 per cent of the total freight equipment of this country is of all-steel or steel underframe construction.

Unusual interest attached to the meetings of the Division on Purchases and Stores. The report of the committee consisted of an entire revision of the stores department book of rules. Under accounting it was noted that the Interstate Commerce Commission reported a reduction of 25 per cent in total stores balances for all railroads, showing "prudent management" since the difficult period after the war. At the Thursday session, D. R. Coleman, of the Worthington Pump and Machinery Corporation, stated that during 1925 more than $21,000,000 was saved by the railroads through better use of fuel.

The machinery exhibits were well grouped this year, and great interest was shown. A number of machine tool builders showed new tools, or machines incorporating new features. Some sales were made from the start, and the "sold to" signs began to go up on the second day of the exhibit. Some of the exhibitors, however, criticised the detached location of the machinery exhibits, and the fact that those who paid admission to the pier were not permitted to visit Machinery Hall unless provided with membership badges. A list of the exhibitors will be found on page 966f.

Start Production on Stinson Airplanes

Production has been started in Northville, Mich., a suburb of Detroit, on the Stinson-Detroiter airplane, designed by Edward A. Stinson. Five finished planes will be turned out by July 1, while the production schedule calls for 25 planes this year.

The Stinson Airplane Corporation has been organized to take over the assets, patents and planes owned by the Stinson Airplane Syndicate, and has been capitalized at $300,000.

Officers are: J. K. Livingston, of McNaughton, Livingston & Griffin, chairman of the board; Edward S. Stinson, president; Henry E. Hund, vice-president; William A. Mara, secretary; Richard Fitzgerald, treasurer. Directors include E. S. Evans, president of the E. S. Evans Co., George M. Holley, president of the Holley Carburetor Co., Luther D. Thomas, president of the Fidelity Trust Co., Frank W. Blair president of the Union Trust Co., Harry Graham, president of Owen & Graham, James M. Evans, president of Evans-Winter-Hebb, William E. Metzer, director of the Federal Motor Truck Co., George E. Buchanan, president of Buchanan & Huff.

The Stinson-Detroiter is a four-passenger, cabin-type plane, powered with a 200-hp. Wright motor, has brakes on the wheels, adjustable stabilizer, and a self-starter for the motor.

Honor Dr. Reusch

A luncheon in honor of Dr. I. Paul Reusch, retiring president of the Deutsches Museum in Munich, Germany, and one of the foremost industrialists in Germany was given at the Chamber of Commerce, New York, on June 10, by the trustees of the Museums of the Peaceful Arts. The feature of the meeting was the presentation by Dr. Reusch of certificates of membership in the Deutsches Museum to Judge Elbert H. Gary, Dr. Michael I. Pupin, Dr. John W. Lieb, E. W. Rice, Jr., and Dr. Calvin W. Rice. The luncheon was attended by many prominent engineers.

Business Depression Continues as Japan Waits Opening of American Silk Market

Electrical and cotton textiles only two industries that show signs of prosperity

BY OUR TOKYO CORRESPONDENT

American market for Japanese silk still prevails in Tokyo financial circles and the long-drawn-out business depression continues. Only two industries appear to be buying machinery in volume sufficiently large to be worth mentioning—electricity and cotton.

With Switzerland excepted, Japan is perhaps the most completely electrified country in the world. Extensive utilization of water power has made current so cheap that electric lights are found in the vast majority of homes. In spite of the fact that consumption is now considerably behind capacity, power firms, particularly those in the Tokyo-Yokohama district, are adding to their equipment steadily.

COTTON SPINNERS PROGRESSIVE

In spite of the disastrous period which the cotton spinners have gone through since the first of the year, they are gradually adding to the number of their looms and spindles. Japanese mills now work in two shifts, from 6 o'clock to 5:30 in each half of the clock.

The government announced on May 22 that the law reducing the working day from 11 actual hours to 10 would be promulgated in June, following adoption by the Privy Council. The change in the work-day will become effective at once, while the prohibition of late night work for women will be put in force in June of 1929. This measure was passed by the Imperial Diet in 1923, but factory opposition delayed its promulgation.

In order to keep the new law from reducing production or greatly increasing cost, Japanese spinners and weavers, especially the former, have been installing new equipment. Since 1920 the number of spindles in the nation has increased from 3,800,000 to 5,300,000. Looking toward the enforcement of the late night work clause, further additions to the number of spindles are being planned.

About a month ago I had occasion to go through the main plant of the Kanegafuchi Spinning Co., in Tokyo. This concern has 32 plants devoted to cotton spinning and weaving, silk reeling and weaving and rayon manufacture. Of these, seventeen are at present spinning cotton yarn and most of them have looms as well. Of the 76,000 spindles in the Tokyo plant, not one was of American make. As a matter of fact, the only pieces of American equipment which I saw were two generators and about 300 Stafford automatic looms. All the other machinery was of British make, by Platt, Stubbs and others. My guide remarked, however, that the American looms had proven far more efficient than the British machines and would probably be used in replacements. However, the real market promises to be for spindles.

Generally speaking, cotton is the only industry independent of government support which appears to be on a firm footing, regardless of its losses. Silk filatures, which are to borrow about 110,000,000, yen from the banks to finance their June cocoon purchases, have not yet paid all they borrowed last June. Woolen manufacturers are said to be indebted to their agents, who have been carrying them along, to the extent of millions.

An interesting fact about the prolonged depression of Japan is that it has unified her industries to a remarkable degree. Concerns faced with bankruptcy have gone to the great family companies which control Japanese finance and have asked for subsidies. The Mitsubishi group is the largest of these, with Yasuda and Mitsui next, in the order named, while Suzuki, Furukawa and Okura are well up in the money peerage. It is probable that at least 200 Japanese firms in every line have received these "subsidies" and are practically controlled by one or another of the family companies.

Samuel Samuel & Co., the largest British importing and agency concern in Japan, has decided to get out of direct business and confine itself to foreign exchange banking. W. McC. Kirkpatrick, its manager, told this correspondent on the occasion of this announcement that the decision had been dictated by the realization that the "foreigner acting as a go-between for foreign producers and Japanese consumers has just about lost his reason for being." The great Japanese houses, he said, have the confidence of foreign firms and know credits thoroughly.

MONOPOLIES ARE PROFITABLE

This statement by Mr. Kirkpatrick has created a furore in the foreign press and the "Importer" and "Constant Reader" have been having their fling. The fact remains, however, that other men in the same business have told your correspondent that the only lines which they can continue to handle with profit are those in which they still have a monopoly, patented and specialized products which American and British manufacturers have refused to place through Japanese agents.

Stock exchange circles are not so pessimistic as they were last month. The volume of trading has declined almost to the vanishing point, but what tone there is is firm. Dealers are anxiously awaiting silk and cotton crop returns and watching the trend in America. It is generally conceded that Japan is due for a boom of some proportions if the American market for her silk recovers. Accordingly, the process of readjustment following the Wall Street collapses of late winter is being watched anxiously.

Japan is steadily improving her foreign trade position. The excess of imports at the end of the first half of 1926 will be about 360,000,000 yen, a decline of 210,000,000 yen from that at the end of June, 1925. The volume of trade, however, has dropped 75,000,000 yen so far.

Due to a steadily falling market, the three flour mills which produce more than 80 per cent of Japan's wheat flour have entered an agreement to restrict production over a two-year period.

For the first time in five years, due to depression, the Bank of Japan is issuing no banknotes against securities and acceptances. Commodity prices in Japan are still declining. The average gross retail index number for May 15, based on 100 for July, 1914, was 202.6, a drop of .39 per cent in a month.

GOVERNMENT SUBSIDY

At a conference among representatives of the Departments of Foreign Affairs, Finance, and Commerce and Industry last week it was decided to advance more money to the Hanyehping Colliery and Iron Works, in China, on the condition that it reopen its plant and start shipping ore for the government steel works at Edamitsu.

The Government Steel Works, in order to meet increasing foreign competition, has cut its spot prices, effective May 15. Round bars are now quoted at 98 yen per ton of 2,240 lb. One-inch plates are 114 yen.

C. of C. Bulletin Points Out Need for Skilled Labor

A warning that a shortage of skilled workmen will continue to exist unless a more concerted effort is made by employers to train apprentices is sounded in a pamphlet on "Apprenticeship" just issued by the Department of Manufacture of the Chamber of Commerce of the United States.

The pamphlet is based on a nation-wide investigation of the subject and contains much useful information concerning methods of training now used in certain industries and vocational schools. Various aspects of the subject are covered under such headings as: "What is an Apprentice?" "Apprenticeship vs. Shop Training," "Apprenticeship in Large Industries," "How Can Small Companies Deal Effectively with Apprenticeship?" "Vocational Education's Part in Apprenticeship," "Co-operating Agencies for Effective Apprenticeship," "The Laying Out of the Course," "The Supervision of the Apprentice," "The Wisconsin Plan of Apprenticeship," and "Selling Apprenticeship."

The purpose of the pamphlet, as explained, is to awaken employers to the need of training skilled workmen to meet the growing demands of industry.

Restricted immigration, the pamphlet states, has reduced the former supply of trained man-power. Also, the tendency has been for boys to drift toward clerical and office jobs. This tendency is many times not justified by the opportunities to advance, but shows a neglect on the part of industry to sell the opportunities afforded the trained man in the shop. Thus a shortage of trained man-power will continue to confront industry unless something is done about it.

Machine Tools Exhibited at Continental Fairs

The annual fair held at Basel, Switzerland, closed on April 27. Among the 1,016 exhibitors were 83 in the electrical section and 64 in the machinery and tools section, and although quite a number of machines and metal objects were shown, it was felt that the machine tool section showed a tendency to disappear. Woodworking machinery was well to the front, however, and many of the exhibits in this line were designed for application in the pattern shop.

The largest machine tool exhibit was that of Christen & Co., Bern, and it consisted of about two-dozen machines, mostly of the familiar type such as upright drills and bench lathes. Schaublin-Villeneuve, Malleray, exhibited a collection of small lathes for watch and instrument work and a new machine for grinding the faces of small disks. Simonet & Co., Solothurn, also exhibited watchmaker's lathes, and F. Grenenberger, Reinach, showed larger sized lathes.

The firm of Gebriider Reiegg, Uster, introduced a small hand- or belt-driven keyway cutter for producing keyways up to 1½ in. wide by 12 in. long. without shifting the work. Another innovation was a vise exhibited by Hegi & Co., Overbourg, in which the gripping and release actions are performed by means of foot-operated levers. Caisse Nationale Suisse d'Assurance en cas d'Accidents, Lucerne, demonstrated machine guards and safety devices that they design. This organization inspects workshops and enforces the adoption of safety devices at the cost of producing them. Special attention has been devoted to press guards.

The Milan Fair

The annual commercial fair at Milan, Italy, has also just ended. One of the permanent buildings erected this year was the Palace of Machinery with a floor space of 3.7 acres. The purpose was to show machines in operation and traveling cranes were provided in every section to facilitate the handling and erection of the machinery. The machine tools were placed together. Considerable variety was noted and many firms outside of Italy exhibited, usually through agencies.

The Italian branch of Alfred Herbert, Milan, was one of the largest exhibitors, and through them some American machines were shown: a Norton grinder, a Fellows gear shaper, and a Heald semi-automatic grinder. Several Herbert automatic lathes and screw machines, drills and the like were also shown, all in operation on some sample work.

La Rigide, Rorschach, displayed a wide range of milling machines, some of them for high production work. One semi-universal machine had eight speeds and eight feeds and could be provided with two horizontal and one vertical spindle. All machines have a quick-return motion to the table. A spiral bevel gear planer of the generating type was noted from the Machine Tool Works Oerlikon. The cutting tools are small and simple and gears up to 27½ in. in diameter can be cut. A new lathe with sixteen speeds was also exhibited by the same company. Provision was made for motor drive in the base of the lathe by means of a belt with a Lenix tightener.

Italian firms showed a planer type miller, a hobbing machine, a 16-spindle drill press, precision grinding machines of many styles, automatic lathes and screw machines, and many others. Il Progresso Industriale, Milan, showed a collection of Soag machines with various welding appliances.

U. S. Buying Power Has Increased Over Five Million Dollars

The United States, in mere population growth during the past five years has acquired more consumption power, or new potential markets, than if she had taken into her confines the entire population of Canada, or that of Australia and New Zealand combined.

The recently estimated population increase of 10,229,000 during the five years 1920-25, according to the National Industrial Conference Board, is 15 per cent more than the population of Canada, and 40 per cent more than that of Australia and New Zealand; it is 38 per cent more than the 1920 population of all the New England states, and 15 per cent more than the aggregate population of the Mountain and Pacific states, comprising Montana, Idaho, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Washington, Oregon and California.

On the basis that the 10,229,000 additional inhabitants of the United States comprise proportionately as many gainfully employed persons as did the total population of the country when the 1920 census was taken, the increase in the gainfully employed would number approximately 3,965,000. At the latest accepted calculation of average annual earnings per gainfully occupied person, according to the board's study, the increase in population therefore would represent an approximate increase in national purchasing power of more than 5½ billion dollars per annum.

In actuality, however, the total purchasing power of the people of the United States has increased considerably more than these figures would indicate, because of the generally reduced cost of living and the resultant higher "real" earnings since 1920, leaving a greater margin of surplus after the purchase of the necessities of life. This is clearly reflected in the growth of savings of the American people, the accumulation of which has strikingly accelerated during the past five years compared with previous years.

National Museum Re-elects

The annual meeting of the National Museum of Engineering and Industry, for some time postponed, was held at the Engineering Societies Building, New York, on May 28. Samuel Insull presided.

Following reports by officers and committees, the revised constitution was adopted and the present board of trustees re-elected.

New Haven Making Ready for Machine Tool Exhibit

Plans for the Sixth Annual Machine Tool Exhibition, scheduled to be held at Mason Laboratory, Yale University, Sept. 7, 8, 9 and 10, are taking very definite form. Over 80 per cent of the available space has been contracted for, which points to even greater success this year than in the past.

The manufacturers who will use this space have in many cases already decided upon the particular machines which they will exhibit. This equipment will demonstrate the most interesting of the many recent developments in the machine tool industry. In order to get the most authoritative advice upon the outstanding machine tool developments actually carried out in the last year, as well as to get information about those upon which experts are now working, the general committee at New Haven has appointed a special advisory committee.

This committee is coöperating with Prof. S. W. Dudley of Yale University, who has been designated by the Machine Shop Practice Division of the A.S.M.E. to develop a technical program, to be presented at the time of the exhibition. The technical sessions will be held at Dunham Laboratory.

Schedule of Papers

A number of very attractive papers are being arranged for, and some of the outstanding men in the machine tool field will be present to present and to discuss them.

The plan at the present is to confine this to five or six of the outstanding improvements in designs, methods or production process, which can each be presented in ten-minute talks followed by ten-minute discussions.

Members of the Society who are users of machine tools are encouraged to designate certain members of their organizations to attend the exhibition and technical sessions, especially on executives' day, which is Thursday, Sept. 9. The committee in charge of the exhibition has set this day aside, in order to give executives an opportunity to study the exhibits unhampered by large crowds.

The headquarters of the exhibition are at 400 Temple St., New Haven, Conn., where many of the members of the general committee and all the members of the local committee may be addressed.

P. & W. Aircraft Co. Adds Four Executives to Board of Directors

The Pratt & Whitney Aircraft Co., of Hartford, Conn., has recently added four members to the board of directors. They are: W. B. Mayo, chief engineer of the Ford Motor Co., Detroit, Mich.; E. A. Deeds, chairman of the board of directors of the Niles-Bement-Pond Co.; Charles F. Kettering, vice-president of the General Motors Corporation, Detroit, Mich.; and Gordon S. Rentschler, vice-president of the National City Bank, New York.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THE effect of political development upon business is often exaggerated but in its politico-economic aspect ex-Senator Brookhart's success in the Iowa primaries is an event of the first importance.

For one thing it probably means the passage of the Haugen Bill or some similar measure and following as it does the defeat of Senator Pepper in Pennsylvania, it is generally construed as evidence that the President's hold upon his party is weakening. This may, or may not be true, but it is a fact that the nomination of a man who would put the control of capital entirely in the hands of labor and limit the return earned to 5 per cent has unpleasantly impressed many who call themselves conservative.

But it is also a fact that it has not had much influence upon prices in the speculative markets as yet, except as it may have helped to advance wheat and corn which have been conspicuously firm.

Slightly higher prices for coffee and rubber are also attributable to politico-economic influences.

In the case of the former a moderate advance followed the success of a coffee loan for £4,000,000 which the State of Sao Paulo offered in London. And the decline in rubber was checked by the belief that if the price stays below 42 cents the Stevenson Plan for restricting exports will soon become effective again.

Cotton on the other hand is lower because rain has fallen in the regions where it was needed and sugar has yielded a few points on sales by holders who have wearied while waiting for an advance that is now overdue.

The current of distributive trade has meantime been moving smoothly but not too swiftly. Consumers and retailers are taking what they need as they need it, but there has been no anticipatory buying.

The result is that manufacturers have been left to hold the bag and curtailment by the cotton mills that have not resorted to it is again being urged.

Statistics are beginning to reflect some decline in building. Bradstreet's reports that in 149 cities the building permits issued in May call for an expenditure of 301 million as against 319 million in the same month last year.

This may explain the slightly lessened activity of the steel industry which is still said to be operating at only 80 per cent of capacity.

But these are all routine developments. They cannot be regarded as symptomatic of any radical change in the outlook. The acid test of our economic independence and stability will come when the surplus of our agricultural production is ready for export. If it can be readily sold abroad all will be well. But the fear that Europe won't buy because she can't pay unless she can continue to borrow here is a ghost that is haunting those who look more than a few months ahead.

A fresh decline in French francs that has again carried them below three cents is therefore causing some concern especially as it has been accompanied by cables which suggest that the French government may decide to embargo or restrict imports in an effort to prevent the export of capital. Expedients of this sort have rarely been successful as capital is elusive and its movements are often invisible. But the movement of merchandise cannot be concealed and if France should be successful in preventing her people from buying from other nations it will follow, as the night the day, that other nations will not buy of her.

The conditions elsewhere in Europe are still unsettled and the continuance of the British coal strike is sorely taxing the endurance and patience of the English people.

It is unofficially estimated that 2,720,000 wage earners including the miners are now unemployed in England. This is of course a heavy load to carry and even stolid John Bull is commencing to show a little weariness, although he seems determined to fight it through in the hope that by so doing he may make future strikes improbable.

Meantime some cargoes of American coal are going abroad, and some British steamers that would normally be coaled in England are taking fuel for the round voyage here.

Taking it all in all Europe seems to have more than her share of the troubles that vex business at present, but in this country the continued ease of money has acted as a shock absorber in protecting American business against influences that might have slightly disturbed confidence if bank credit were less abundant.

Mr. Mellon's announcement that the Treasury will be able to meet its June obligations without borrowing has emphasized this condition, and the investment demand for good bonds appears to be almost insatiable. The plethora of capital seeking employment has also been reflected in the buying of U. S. Steel common that has been the outstanding feature of the week.

The railroad stocks including particularly New York Central have also been strong, and on the Curb as well as over the counter and on the Stock Exchange the securities that have any right to be classed as investments have been freely bought.

The truth is that the existence of the Federal Reserve System and the change in our national fortunes by virtue of which America has become the world's creditor instead of its debtor has created a condition to which the people of this country have not yet become accustomed.

What's Doing in Industry

The volume of sales of machinery and machine tools in the first half of June bears out earlier predictions that the month's business would be good and would exceed either April or May. In practically every large industrial center sales are increasing. It is evident from the present trend of business that sales that were held up in May because of disturbed industrial conditions generally are now closing, the alarm having proved false.

Contemplated production expansions in the automotive industry have brightened the prospects in Detroit, where sales and inquiries are showing a better tone. In Chicago the railroads are closing on old lists, and the used tool market is improving. Cincinnati reports an increase in sales volume with good future prospects. A varied demand for tools has offered encouragement in Indianapolis.

The South reports sales in excess of last year, many industrial enterprises furnishing a variety of business. Sales and inquiries have increased in the New York market, some old quotations now closing. A steady improvement is reported in Canada, metal-working industries being very busy.

The continued ease of money in this country has acted as a shock absorber in protecting American business against influences that might have slightly disturbed confidence if bank credit were less abundant.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Detroit

Sales of machinery and machine tools in Detroit and the other industrial centers of southeastern Michigan remain somewhat spotty with some signs on the horizon that a change for the better will occur shortly.

The plans of practically every unit of the General Motors Corporation to increase production and purchase new equipment has made representative machine tool dealers more optimistic about the immediate future.

For the most part sales are scattered, with no plant in particular buying in any large quantity. Several sizeable lists are out, however, and actual orders on many of the larger jobs will be placed within the next two months.

A persual of the plans announced by the General Motors officials for the new plant of the Pontiac Six just north of the city limits of Pontiac show that eventually $15,000,000 will be invested in this group of buildings. The $5,000,000 program which has already been undertaken includes only the buildings, and machinery for the units, which will be ready for production by January 1, 1927. The Pontiac plant will adjoin the new buildings of the Fisher Body Corporation.

As a result of new ideas in the manufacture of automobile bodies suggested at the recent meeting of the Automobile Body Builders' Association in Detroit some machine tool firms are anticipating some sizeable orders from the body plants.

Some standard equipment has been recently placed in the Hudson factory, while Cadillac has been buying in limited quantities. Ford is rather quiet at present, but it is felt that some radical changes will be made shortly at the local plants which will mean numerous changes in the machinery along the assembly and motor lines.

New York

Business in this market has shown a fair increase in the past ten days. Following the slump of May, the month of June has shown great promise. It is evident from the present trend of sales and inquiries that orders that were held up last month because of disturbed industrial conditions are now being acted upon. Many dealers report that there has been unusual activity in the first half of the month and indications are that it will continue for some time.

Small job shops are coming into the market for special tools. These orders are mostly for single pieces, but there are enough of them to make a substantial total. Railroads are also active, not a few tools being bought on old inquiries.

Large industrials which had pending orders have closed on some of them and new inquiries from this source give promise of more sales in the immediate future.

The used tool market continues active, although dealers still complain of the shortage of first-class machines at fair prices.

Cincinnati

An increase in the volume of sales in the past week is reported by Cincinnati machine tool manufacturers and selling agents, and in no case has business shown a falling off. There was not a corresponding increase in the number of inquiries received, but this is not taken as an indication of a decreased demand.

There prevails among the manufacturers a feeling that sales have passed the low point and that from now on the curve will gradually ascend. While no great market activity is expected until fall, it is thought that there will be at least a fair demand through the summer months.

Railroads did some buying in the week and it is thought that in a very short time large orders will be placed by three roads that are in the market for tools. A buyer from a large automobile concern has been in the city several days and some very large orders for tools are expected to be the result of his investigations.

Some orders for tools are reported as having been received from the coal and coke fields. A livelier demand from industrial users of tools is reported. Concerns in the automotive industries bought a few replacements. Other orders came from concerns in various branches of the metalworking industry, located in all parts of the country. The week's bookings were well diversified as to types and sizes of tools.

Factory production, it is thought, will be maintained at its present level for the next few weeks, after which there will be a gradual increase in output.

Indianapolis

Business in machinery and machine tools is just about holding its own as compared with the same period last year. The situation as a whole has little to recommend it were it not for the optimistic viewpoint the trade has for future business. In some lines, there is rather an active demand, but other lines are slow, though there appears to be a good volume of inquiries.

Local and state factories are working steadily and tool demand is good. Demand for machinery from the automotive industry is not so good, preparations having been made earlier in the year to take care of probable expansion in production. A fair demand both for tools and machinery comes from the truck factories in the southern part of the state. The coal fields have produced some good business during the last two weeks. The demand for special road building machinery is fair.

Railroad demand is not so good. Even though many shops have increased their number of employees, purchases are being held to a minimum.

A good demand continues to come from the lumber factories both in the South and on the West coast. Planers, saw machinery and similar equiment are moving rather readily. More inquiries are being received by dealers in used equipment, but sales are not any better than they were this time last year.

Southern District

Little change is noted in the Southern machinery and tool market. Sales are slightly better than last year at this time, but the expected improvement has not yet materialized. The outlook, however, is considered very bright by a majority of dealers and distributors due to the exceptional amount of factory construction in progress and the large amount of road building and general construction.

Textile sales show a fair improvement the past two weeks and are quite a bit better than they were at this time last year, especially sales to new textile plants, several of which are now being built in the Southeast.

Garage equipment also is showing steady improvement and for the first six months of the year will compare very favorably with the best seasons, in spite of dull business earlier in the year. A considerable amount of used and rebuilt equipment is being sold in this field, particularly lathes, drill presses and cylinder grinding machines.

Smaller shops are not doing much buying nor is the outlook very bright, though business seems to be better than usual, according to a survey of conditions recently among members of the Southern Metal Trades Association.

Construction machinery and contractors' equipment is fairly good, while the inquiry gives promise of steady improvement in the next month or so. The same is true of road building machinery and tractors, the latter selling on a particularly good basis to farmers, but with industrial sales showing only a slight improvement over last season.

Woodworking and sawmill machinery seem to have slowed up a little the past two weeks after steady activity for nearly five months, but the lull is thought only temporary as the furniture, lumber and millwork industries in the South are doing considerable construction.

Chicago

Little change is noted in the machine tool market for the last week. Such increase in the volume of sales as was last noted has been generally maintained. In particular, dealers in used machinery are experiencing an improvement, and are closing inquiries which for some time past have been accumulating. One dealer who specializes in used tools states that his sales thus far in June had exceeded those for the entire month of May. This, however, is exceptional, although there has been a better demand during the first ten days of June than for the corresponding period last month.

While railroads continue to send in inquiries for new and used equipment, both heavy and light, they are at the same time closing on old lists. The Illinois Central has within the last two weeks placed several orders to complete the equipment of its new shops at Paducah, Ky. The Chicago & Northwestern is inquiring for special machinery, specifically, bushing machines.

The prevailing feeling in the trade as a whole is, that business will show a gradual improvement as the year advances, and that month of June will prove considerably better than May in the matter of actual sales.

Canada

Reports from all sections of Canada indicate that the metalworking industry is well employed. Industrial operations are continuing at such a rate that there is a steady call for material.

Iron and steel production continues fairly steady, with mills well engaged on important work. Some reduction in operation of foundries is noted. The Algoma Steel Corporation was successful in getting an order from the Canadian Pacific Ry. a few days ago that makes it possible for the company to proceed with production at capacity rate. The company's structural steel mill is now rolling steel for the Welland ship canal.

The improvement in automobile production in recent months is reflected in the increase in imports of auto parts from the United States as revealed by figures just issued by the government. The most recent report on auto production in Canada shows that the cumulative production for the first quarter of the year showed an advance of 45 per cent over the total for the same period in 1925.

Thomas Bradshaw, general manager of the Massey-Harris Co., recently reported that the Canadian business of the company has been showing marked improvement. There has been more general buying of farm equipment this year as a direct result of better conditions. The general manager of the Canadian Locomotive Co. has reported that the company is very busy on recent orders received from the C.P.R. This work involves capacity operation well into September. Business in the wholesale hardware trade has improved greatly throughout the Dominion and repeat orders for seasonable lines are numerous and of generous proportions.

Exhibitors at Railway Convention

Among the exhibitors of machinery and allied products at the annual convention of the American Railway Association in Atlantic City last week were: Air Reduction Sales Co., New York City; Ajax Manufacturing Co., Cleveland, Ohio; American Car and Foundry Co., New York City; American Engineering Co., Philadelphia, Pa.; American Hoist and Derrick Co., St. Paul, Minn.; American Tool Works Co., Cincinnati, Ohio; Andrix Lock Nut Co., Inc., Adrian, Mich.; E. C. Atkins & Co., Indianapolis, Ind.; Automatic Transportation Co., Inc., Buffalo, N. Y.; John Bath & Co., Worcester, Mass.; Charles H. Besly & Co., Chicago, Ill.; Blacker Engineering Co., New York City; Black & Decker Manufacturing Co., Towson, Md.; Boss Bolt and Nut Works, Chicago, Ill.; Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.; W. L. Brubaker & Bros. Co., Millersburg, Pa.; Buckeye Portable Tool Co., Dayton, Ohio; Buffalo Forge Co., Buffalo, N. Y.; Bullard Machine Tool Co., Bridgeport, Conn.; Carbo-Oxygen Co., Pittsburgh, Pa.; The Carborundum Co., Niagara Falls, N. Y.; Carlton Machine Tool Co., Cincinnati, Ohio; Chicago Pneumatic Tool Co., New York City; Cisco Machine Tool Co., Cincinnati, Ohio; Cleveland Pneumatic Tool Co., Cleveland, Ohio; Cleveland Twist Drill Co., Cleveland, Ohio; Consolidated Machine Tool Corporation of America, Rochester, N. Y.; Cresson Morris Co., Philadelphia, Pa.; Crowe Manufacturing Co., Cincinnati, Ohio; Davis Boring Tool Co., St. Louis, Mo.; Dayton Pneumatic Tool Co., Dayton, Ohio; Diamond Machine Co., Providence, R. I.; Henry Disston & Son, Inc., Philadelphia, Pa.; Gairing Tool Co., Detroit, Mich.; General Electric Co., Schenectady, N. Y.; Gerrard Wire Tying Machine Co., Chicago, Ill.; Gisholt Machine Co., Madison, Wis.; Goddard & Goddard Co., Detroit, Mich.; Gould & Eberhardt, Irvington, N. J.; G. A. Gray Co., Cincinnati, Ohio; Grip Nut Co., Chicago, Ill.; Hanna Engineering Works, Chicago, Ill.; Hauck Manufacturing Co., Brooklyn, N. Y.; Heald Machine Co., Worcester, Mass.; Hyatt Roller Bearing Co., Newark, N. J.; Independent Pneumatic Tool Co., Chcago, Ill.; Ingersoll Milling Machine Co., Rockford, Ill.; Ingersoll-Rand Co., New York City; International Machine Tool Co., Indianapolis, Ind.; Irwin Auger Bit Co., Wilmington, Ohio; Jones & Lamson Machine Co., Springfield, Vt.; Kearney & Trecker Corporation, Milwaukee, Wis.; Keller Mechanical Engineering Corporation, Brooklyn, N. Y.; William H. Keller, Inc., Grand Haven, Mich.; Keystone Grinder & Manufacturing Co., Pittsburgh, Pa.; King Pneumatic Tool Co., Chicago, Ill.; Landis Machine Co., Waynesboro, Pa.; The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio; Lehman Machine Co., St. Louis, Mo.; Link-Belt Co., Chicago, Ill.; Lucas Machine Tool Co., Cleveland, Ohio; MacLean-Fogg Lock Nut Co., Chicago, Ill.; Manning, Maxwell & Moore, Inc., New York City; McCabe Manufacturing Co., Lawrence, Mass.; McCrosky Tool Corporation, Meadville, Pa.; Metal & Thermit Corporation, New York City; The Alexander Milburn Co., Baltimore, Md., Morton Manufacturing Co., Muskegon Heights, Mich.; Niles Tool Works Co., Hamilton, Ohio; Norton Co., Worcester, Mass.; R. D. Nuttall Co., Pittsburgh, Pa.; Ohio Machine Tool Co., Kenton, Ohio; O. K. Tool Co., Inc., Shelton, Conn.; Henry Pels & Co., Inc., New York City; Pratt & Whitney Co., Division Niles-Bement-Pond Co., Hartford, Conn.; Production Machine Co., Greenfield, Mass.; Racine Tool & Machine Co., Racine, Wis.; Rockford Machine Tool Co., Rockford, Ill.; E. J. Rooksby & Co., Philadelphia, Pa.; Joseph T. Ryerson & Son, Inc., Chicago, Ill.; Safety Emery Wheel Co., Springfield, Ohio; Schatz Manufacturing Co., Poughkeepsie, N. Y.; William Sellers & Co., Inc., Philadelphia, Pa.; S K F Industries, Inc., New York City; Skinner Chuck Co., New Britain, Conn.; Southwark Foundry and Machine Co., Philadelphia, Pa.; Special Bolt Machinery Corporation, New York City; L. S. Starrett Co., Athol, Mass.; Sullivan Machinery Co., Chicago, Ill.; Swift Electric Welder Co., Detroit, Mich.; Swind Machinery Co., Philadelphia, Pa.; Thomson Electric Welding Co., Lynn, Mass.; Timken Roller Bearing Co., Canton, Ohio; H. B. Underwood Corporation, Philadelphia, Pa.; Vulcan Electric Brazer and Welder Co., Paterson, N. J.; Walraven Co., Atlanta, Ga.; Warner & Swasey Co., Cleveland, Ohio; Watson Stillman Co., New York City; Western Tool and Manufacturing Co., Springfield, Ohio; Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.; Worthington Pump and Machinery Corporation, New York City; Yale & Towne Manufacturing Co., Stamford, Conn.

Canada Modifies Auto Tariff Schedule

Further important changes and modifications in the Canadian tariff on automobiles, including provision for the free entry of certain automobile parts, not made in Canada, have been announced.

Certain automobile parts such as horns, distributors, etc., of a kind not made in Canada, and when imported by automobile manufacturers for use as original equipment in the manufacture of automobiles, enter free of duty.

Chassis enter at the same tariff rates as given for automobiles, namely 12½ per cent, British preference, 17½ per cent intermediate, and 20 per cent general, for cars valued at $1,200 or under, and 15 per cent, 25 per cent and 27½ per cent respectively for cars valued at $1,200 and over.

Tops, wheels and bodies for automobiles will be dutiable at 20 per cent, British preference, 27½ per cent intermediate, and 30 per cent general.

Chassis, tops, wheels and bodies for locomotives, motor cars for railways and tramways, will be dutiable 22½ per cent British preference, 30 per cent intermediate, and 35 per cent general.

Twenty-five per cent drawback on materials used in automobile manufacture to be granted till April 1, next, if 40 per cent of the cost of the finished article has been produced in Canada.

The first amendment, admitting parts free, is to encourage the assembly of motor cars in Canada, rather than in the United States; the second, is to prevent people from driving an expensive new car for two days and importing it at a low valuation.

What the Railroads Are Doing

Shipments of railroad locomotives during May aggregated 140, of which 105 steam and 14 electric were for domestic use and 12 steam and 9 electric for foreign use, according to the Department of Commerce. The total compares with 150 locomotives shipped during April and 101 in May, 1925.

During the first five months 737 locomotives were shipped as against 505 during the corresponding period of last year. At the close of May there were unfilled orders for 726 engines, compared with 713 at the end of April and 478 at the end of May last year. Of the unfilled orders at the end of May, 585 steam and 46 electric locomotives were for domestic use, and 72 steam and 23 electric for foreign use.

The largest purchases of freight equipment by the railroads in several weeks took place last week. The Baltimore & Ohio bought 1,000 box cars, divided 500 each to the Standard Steel and the Bethlehem Steel Corporation. The Delaware, Lackawanna & Western placed orders with the American Car and Foundry Co. for 400 seventy-ton all-steel coal cars, 500 fifty-five-ton box cars and 2 baggage and mail cars; also 200 fifty-five-ton box cars with the Magor Car Co.

The Central Railroad of New Jersey purchased 1,000 box cars, divided 400 each to the Standard Steel and Bethlehem Steel and 200 to the American Car and Foundry. The Tennessee Central purchased 275 miscellaneous freight cars from the Pressed Steel Car Co.

Interest of the locomotive manufacturers was aroused by the placing of an order by the Illinois Central for fifty heavy locomotives with the Lima Locomotive Works. The engines are of the 2-8-4 type, weighing 193 tons each, and with tender 321 tons each.

Many of the railroads have held off making purchases on the theory that prices would be lower later in the year. These large orders, however, indicated, in the opinion of many railroad men, that purchasing agents had reached the conclusion that the predicted business depression was not coming to pass and now was a good time to buy.

The first of seven electric locomotives of a new type, which utilize the advantages of both alternating and direct current, was shipped from Erie, Pa., last week by the General Electric Co. to the New York, New Haven & Hartford R.R. These locomotives each contain a traveling substation, picking up 11,000 volts alternating current from the overhead trolley wire and changing it to 600 volts direct current used to operate the driving motors.

Authority to assume liability for $17,030,000 of equipment trust certificates has been granted by the Interstate Commerce Commission to the Pennsylvania Railroad Co. This amount is to apply on the purchase of 200 mountain-type steam locomotives at $75,573 each; two thousand 50-ton automobile box cars at $2,137 each; 74 steel passenger coaches at $27,910 each; 7 steel passenger-baggage cars at $37,051 each; 8 steel passenger-cafe cars at $37,051 each; 20 steel electric motor cars at $43,125 each; 125 steel baggage-express cars at $12,497 each.

Repairing of all work equipment used on the Western region of the Pennsylvania railroad will be done at the Fort Wayne, Ind., shops following an order which authorized transfer of such repairs from the Logansport, Ind., shops. The machinery to be repaired consists of wrecking derricks, all maintenance of way equipment, including pile drivers, rail pickers, steam shovels, cranes, clamshell buckets and similar apparatus.

News of the Automotive Industry

Production of the G-Boy one-ton truck announced on May 6 by Dodge Brothers, Inc., is on a basis of 100 daily. From May 6 to May 31, total G-Boy orders amounted to 4,612.

The Buick Motor Car Co. in May delivered 30,000 cars at retail, and is now operating on a schedule of 1,000 cars a day. For the first five months, retail deliveries totaled approximately 125,000 cars, or 68 per cent more than were delivered in the corresponding period last year.

The Paige-Detroit Motor Car Co. in May shipped 4,909 cars including both Paiges and Jewetts. This was an increase of 6 per cent over April. The new Paige models introduced in February have met with big demand. Six times as many were shipped in the first five months this year as in same period of 1925. Production schedule for June calls for increases over May in both the Paige and the Jewett line.

The Morgan Construction Co., of Worcester, Mass., is building for the Ford Motor Co., at River Rouge, what is said to be one of the largest and probably the most modern steel plant in the world. The equipment, much of which is being built in the Worcester works of the Morgan company, is on a huge scale, the contracts involving several millions of dollars. The plant, when completed, will consist of a blooming mill, with a capacity larger than any similar mill anywhere; a 14-in. merchant mill, an 18-in. combination billet and sheet mill, a 12-in. spring mill and a 10-in. combination rod mill. The blooming mill already is in operation. Using 1,500-lb. billets it can roll 100,000 tons a month, and is designed so that two more stands of 42-in. rolls may be added if the ingot size is changed to 3,000 lb. There is also space to install a reversing blooming mill, should the size be increased.

Personals

W. E. JERAULD has been appointed works manager of Manning, Maxwell & Moore, Inc., at Boston, Mass.

G. S. ASHMUN has been appointed general superintendent of the Lakeside Works of the Otis Steel Co., of Cleveland.

C. F. PALMER has been appointed general sales manager of the Pittsgurgh Steel Co. He was formerly district manager for the company in Chicago.

ROBERT ATKINSON, of the Halcomb Steel Co., has been elected chairman of the Detroit Chapter of the American Society for Steel Treating.

W. W. WEBBER has resigned from the Deane Works of the Worthington Pump and Machinery Co. and has become sales engineer for the Hyatt Roller Bearing Co.

C. V. JAMES, of A. A. James Ltd., West Bromwick, England, is in the United States to study spring making machinery for use in the new plant of his company.

MAGNUS W. ALEXANDER, chairman of the National Industrial Conference Board, has gone to Europe for an extended tour of three months.

A. W. TRICKEY, who for many years has been the Calgary, Alberta, manager of the Massey-Harris Co., Ltd., has been promoted to the charge of the company's Winnipeg branch.

J. A. SHELBURNE, who has been manager of the Terre Haute Grinding and Machine Co., Terre Haute, Ind., since November of last year, has purchased all other interests in the plant and is the sole owner.

J. N. HEALD, of the Heald Machine Co., Worcester, Mass., sailed on May 30 for Europe. He will spend two months on the continent visiting the company's representatives.

L. P. BLOT, superintendent of the Peck, Stow & Wilcox Co., Southington, Conn., for 14 years, has resigned. Mr. Blot will take a long vacation before considering other connections.

W. C. LLOYD, of 913 Empire Bldg., Pittsburgh, Pa., has been appointed representative in that district for the Milwaukee Crane and Manufacturing Co., of Milwaukee.

PROFESSOR T. MCLEAN JASPER, formerly of the University of Illinois, has been appointed head of the research department of the A. O. Smith Corporation, of Milwaukee, manufacturer of automobile frames.

C. A. BOURNE, of S. A. Cutters Ltd., 18 Berners St., London, W. I., is spending six months in the United States in an endeavor to place the American rights for the Burns gearless, reversing, speed reducer.

JOHN H. NEBEL, who has for several years been attached to the sales staff at the home office of the Gisholt Machine Co., in Madison, Wis., has been appointed representative for the eastern half of Wisconsin, with headquarters at Milwaukee.

R. G. DONNAY and his five associates in the firm of Chenard & Walcker, Gennevillers, France, sailed for home from New York on June 5, after spending a month in visiting the leading American automobile plants and machine tool factories.

JOHN BOYD has resigned as manager of the Grimes Foundry and Machine Co., Bluffton, Ind., and will leave for Santa Fe, N. M., where he will reside on a ranch he recently bought. Mr. Boyd will be succeeded by Ed Cottingham, formerly of Bluffton, and at one time manager of the foundry.

P. F. MCDONALD, president of P. F. McDonald & Co., of Boston, Mass., is now in Sweden on a business trip. P. F. McDonald & Co., importers of Swedish iron and steel, represent the Sandviken Steel Works, of Sandviken, Sweden; Fagersta Bruks, of Fagersta, Sweden; and Hellefors Bruks, Hellefors, Sweden.

T. B. PURCELL, vice-president of the Peoples Gas, light and Coke Co., of Chicago, has been appointed general chairman of the convention committees for the Eighth Annual Steel and Machine Tool Exposition to be held in Chicago, Sept. 20 to 24, by the A.S.S.T.

CHARLES M. GEARING of Meriden, Conn., and SIDNEY E. STOCKWELL, of Hartford, were recently elected to the board of directors of the New Departure Manufacturing Co. Mr. Gearing is manager of the Meriden division, and Mr. Stockwell is manager of the Hartford division of the company.

FRANCIS HODGKINSON, for many years chief engineer of the South Philadelphia Works of the Westinghouse Electric and Manufacturing Co., has been appointed consulting mechanical engineer for the whole organization. A. D. Hunt has been appointed manager of engineering, a position created recently to replace that of chief engineer.

Business Items

Articles of incorporation have been filed with the secretary of state of Indiana by the Sanworth Tool Manufacturing Co.

The Hyatt Roller Bearing Co. announces the removal of its Worcester, Mass., offices from the Park Bldg., to the Central Bldg., in that city.

The Gibb Welding Machines Co., of Bay City, Mich., has started construction of an addition to its plant which will double the manufacturing capacity.

The Detroit Power Screwdriver Co., of 419 Riopelle St., Detroit, has begun the manufacture of the Universal magazine feed screwdriver.

The National Supply Co., of Toledo, announces the opening of a sales office at 211 McCrea St., Indianapolis. Machine tools and supplies will be carried in stock there.

The Kenmore Gear and Machine Co. has been organized and incorporated at Kenmore, Ohio, to operate a general machine shop and to manufacture gears.

The engineering department of the Graham Brothers Truck plant at Evansville, Indiana, will be transferred to the Dodge Brothers plant in Detroit in July.

The Columbia Metal Products Co., of South Bend, Ind., has filed incorporation papers with the secretary of state at Indianapolis. The company will manufacture all kinds of metal products.

The Grace Machinery Co., of Worcester, Mass., has purchased the Worcester Machinery Co. and will operate both companies. Harris Grace is head of the two firms.

E. L. Thomas, manager of the Knoxville, Tenn., offices of the Sullivan Machinery Co., of Chicago, announces the removal of the company's Knoxville branch from 614 Market St. to larger quarters at 611 to 615 General Bldg., located at 623 Market St.

Articles of incorporation have been filed with the secretary of state of Indiana by the Ri-Ta Manufacturing Co., of Indianapolis. The company will manufacture and sell machinery, machine equipment and tools.

The Baldwin Locomotive Works, of Philadelphia, has purchased a controlling interest in the Midvale Co., manufacturer of heavy forgings and locomotive tires. There will be no change in policy or management of the latter organization.

The General Automotive Corporation, recently incorporated in Indianapolis will start the manufacture of an anti-slap piston for automobile motors on which patent rights for manufacture and the sale have been obtained from the Anti-slap Piston Co., of Rahway, N. J.

Botwinick Bros., Inc., of New Haven, Conn., are liquidating over 1,100 surplus machine tools located at the plant of the Colts Patent Firearms Co., in Hartford. The equipment consists of a great variety of tools of standard make. Information regarding this sale can be had from the Botwinick company at 122 Huyshope Ave., Hartford, Conn.

The new addition to the plant of the George M. Diehl Machine Works, at Wabash, Ind., recently was opened to the public. The company manufactures woodworking machinery. The management provided an orchestra and everybody in the city was invited. The addition has just been completed and doubles the floor space of the plant. Much new machinery has been installed.

Obituaries

RICHARD HENRY HATHURST, for more than twenty years chief draftsman of the Butler Machine Tool Co., Ltd., Halifax, Yorkshire, manufacturer of machine tools of a reciprocating type, died at Halifax on May 22. He was 68 years of age.

CHESTER D. MASSEY, noted Canadian industrialist and honorary president of the Massey-Harris Co., Ltd., died at his home in Toronto on June 2, in his 76th year. The late Mr. Massey was born in Haldimand Township. He was a son of the late Hart A. Massey who established the Massey-Harris Co.

FRANK H. COOLIDGE, of Atlanta, died recently at a private sanitarium in Atlanta at the age of 70 years. Mr. Coolidge was probably one of the best known traveling representatives identified with the machinery business in the South, as well as one of the oldest in point of continuous service. For the past forty years he has traveled for the American Brake Shoe and Foundry Co., of New York, having first joined this company in 1885.

Forthcoming Meetings

Society of Industrial Engineers. Thirteenth national convention, Bellevue-Stratford Hotel, Philadelphia, June 16, 17 and 18. Executive secretary, George C. Dent, 608 S. Dearborn St., Chicago.

American Society for Testing Materials. Haddon Hall Hotel, Atlantic City, N. J., June 21 to 25. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers. Spring meeting, Palace Hotel, San Francisco, Calif., June 28 to July 1. Chairman of convention, Warren H. McBride, the California and Hawaiian Sugar Refining Co., 215 Market St., San Francisco.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under Association. R. E. Kennedy, secretary, 909 the auspices of the American Foundrymen's W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

The Weekly Price Guide

Rise and Fall of the Market

AT BIRMINGHAM, No. 2 fdry. pig iron is down $1 per ton to $21, as against $22 one month ago and $20@$21 at this time last year; inquiries are more active in New York. Despite the drop in steel demand, as shown by unfilled tonnage figures issued June 10, the price weakness in the current market is mainly in sheets. Orders on books of the U. S. Steel Corp., May 31, totaled 3,649,250 tons, compared with 3,867,976 on Apr. 30 and 4,049,800 tons, May 31, 1925. Steel bars sell at $1.90@$2 per 100 lb., Pittsburgh; plates at $1.90 and shapes, $1.80@$1.90, per 100 lb., f.o.b. mill. Prices of non-ferrous metal products are firmer than they have been recently; some grades of scrap are up. Linseed oil rose 0.3c. per lb. at New York, June 9, 1926.

(All prices as of June 11)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	24.27
Southern Ohio No. 2	24.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	28.67
Basic	22.26
CHICAGO	
No. 2 Foundry local	22.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	21.27
Basic	21.27
Bessemer	21.27

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.40@2.50	3.89	3.15	3.50
No. 12	2.45@2.55	3.94	3.20	3.55
No. 14	2.50@2.60	3.99	3.25	3.60
No. 16	2.60@2.70	4.09	3.35	3.70
Black				
Nos. 18 to 20	3.05@2.15	4.30	3.65	3.90
Nos. 22 to 24	3.10@3.20	4.35	3.70	3.95
Nos. 26 and 27	3.15@3.25	4.40	3.75	4.00
No. 28	3.25@3.35	4.50	3.85	4.10
Galvanized				
No. 10	3.50@3.60	4.65	4.00	4.25
Nos. 12 to 14	3.60@3.70	4.75	4.10	4.35
No. 16	3.75@3.85	4.90	4.25	4.50
Nos. 18 to 20	3.90@4.00	5.05	4.40	4.65
Nos. 22 to 24	4.05@4.15	5.20	4.55	4.80
Nos. 26 and 27	4.20@4.30	5.35	4.70	4.95
No. 28	4.50@4.60	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	58%	45%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	55%	42%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches External	Diameter in Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness B.W.G. and Decimal	Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1½	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18½	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	15.12½		
Tin, 5-ton lots, New York	61.25		
Lead (up to carlots) E. St. Louis	7.65	New York	8.50
Zinc (up to carlots) E. St. Louis	7.12½	New York	8.00

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	12.50	16.50	10.50
Copper sheets, base	22.50	22.50	22.50
Copper wire, base	19.25	16.50	16.00
Copper bars, base	22.12½	22.12½	21.87½@22.12½
Copper tubing, base	24.25	24.25	24.25
Brass sheets, base	18.87½	18.87½	18.87½
Brass tubing, base	23.50	23.50	23.50
Brass rods, base	16.62½	16.62½	16.62½
Brass wire, base	19.37½	19.37½	19.37½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	12.75	12.55	12.27
Solder (½ and ½), (case lots)	36.75	40.00	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			74.25
Commercial genuine, intermediate grade			54.00
Anti-friction metal, general service			30.50
No. 4 babbitt (f.o.b.)			13.62½
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 31.00	Electrolytic 38.00	Shot 32.00	

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.75 @12.00	11.25	10.75@11.25
Copper, heavy, and wire	11.00 @11.50	11.50	10.25@10.75
Copper, light, and bottoms	9.50 @10.00	9.75	9.25@ 9.75
Heavy lead	6.62½@ 6.87½	6.50	6.00@ 6.50
Tea lead	4.50 @ 4.75	5.00	5.00@ 5.50
Brass, heavy, yellow	7.00 @ 7.25	7.25	7.00@ 7.50
Brass, heavy, red	9.00 @ 9.50	9.50	8.25@ 8.75
Brass, light	5.75 @ 6.00	6.00	6.25@ 6.75
No. 1 yellow rod turnings	8.00 @ 8.25	8.00	7.50@ 8.00
Zinc	4.25 @ 4.75	4.00	4.00@ 4.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.18	36.00 per M	.16
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	3.60†	3.35	4.25‡
Linseed oil, per gal., 5 bbl. lots	.86¼	.96	.92
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*In 175 lb. kegs. † Per 150 lb. lot. ‡In 425 lb. barrels

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1662½	.1662½	.1587½
Solder (½ and ½)	per lb.	.3675	.4012½	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (⅛ in.)	per 100 lb.	7.00	7.00	7.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	30–10%
Machine bolts up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		2.75@ 3.00
Coke, prompt foundry, Connellsville	per net ton		4.00@ 4.50
White lead, dry or in oil	100 lb. kegs		New York, 15.25
Red lead, dry	100 lb. kegs		New York, 15.25
Red lead, in oil	100 lb. kegs		New York, 16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{1}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in.. 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ⅛-in., $7.00* per 100 lb. at New York warehouses; ¼-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Chicago—Pheoll Mfg. Co., 5700 West Roosevelt Rd.—automatic machines, electrically operated, for the manufacture of machine screws, stove bolts, nuts and rivets for proposed 1 story, 62x350 ft. factory. Estimated cost $100,000.

Ind., Anderson—Remy Electric Div., General Motors Corp., Columbus Ave. and Belt R.R.—new machinery for the manufacture of motors for proposed 1 story, 200x500 ft. factory. Estimated cost $180,000.

Ind., Michigan City—Cabranette Co., 38 North Michigan Ave., Chicago — shears, punches, belt conveyors for loading, etc. (later) for proposed 1 story, 90 x 500 ft. factory.

Kan., Topeka — Capital Iron Works, Seventh and Holliday Sts.—equipment including punches, etc., for proposed factory.

Mass., Boston — Schoolhouse Dept. receiving bids until June 24 for metal working machinery for new East Boston high school.

Mass., Boston—Suburban Realty Corp., c/o E. B. Stratton, 25 Arch St., Archt.—miscellaneous tools and equipment for proposed 3 story garage. Estimated cost $250,000.

Mass., Brockton—R. Thompson, 42 Cottage St.—miscellaneous tools and equipment for proposed 2 story, 40 x 115 ft. repair and service garage. Estimated cost $50,000.

Mass., Dorchester (Boston P. O.)—S. Waldman, 101 Esmond St.—miscellaneous tools and equipment for 2 story repair and service garage. Estimated cost $100,000.

Mass., Jamaica Plain (Boston P.O.)—Buff & Buff Mfg. Co., Green St. (surveying instruments)—additional machinery for proposed addition to plant.

Mich., Detroit—L. F. Hanger Co., 2559 Bellevue Ave.—Warner & Swasey hand screw machine No. 6.

O., Canton—Canton Bridge Co., Belden and 10th Sts. N. E.—angle bender with vertical rolls, capacity 6x4x½ angles at minimum radius 50 ft.

Wis., Racine — Standard Foundry Co., 1600 Kewaunee St.—electric furnace, electric crane, etc., for proposed 1 story, 112 x 240 ft. foundry. Estimated cost $150,000.

Que., Rimouski—Pierre Vaillancourt—additional equipment for machine shop.

Que., Roberval — Trottier Freres — machinery and equipment for proposed addition to machine shop.

Australia, Melbourne—Victorian Government Railways will receive bids until July 28 for one plain grinding machine.

Opportunities for Future Business

Calif., Los Angeles—Pike Auto Trailer Works, 701 East 7th St., awarded contract for the construction of a 1 story, 40x200 ft. shop at Santa Fe Ave. and 26th St.

Conn., Hartford—Royal Typewriter Co., 150 New Park Ave., is receiving bids for the construction of a 2 story, 95 x 210 ft. factory. Estimated cost to exceed $40,000. Greenwood & Noerr, 847 Main St., Archts. Noted May 27.

Ill., Chicago—F. Kaplan, c/o Fox & Fox, 38 South Dearborn St., Archts., awarded contract for the construction of a 3 story, 93 x 168 ft. garage at 3257-3263 Broadway. Estimated cost $300,000.

Ind., Gary—Heat Light and Water Co., awarded contract for the construction of a 3 story, 125 x 125 ft. warehouse and garage. Estimated cost $200,000.

Kan., Topeka — Capital Iron Works, Seventh and Holliday Sts., is having plans prepared for the construction of a factory including machine shops, plate and bar buildings, etc. Estimated cost $150,000. Private plans.

Mass., Boston—J. Magnes, 18 Tremont St., will build a 1 story repair and service garage at Floyd & Bosswood Sts. Estimated cost $40,000. S. E. Moffie, 51 Cornhill, Archt.

Mass., Boston—Suburban Realty Corp., c/o E. B. Stratton, 25 Arch St., awarded contract for the construction of a 3 story, 60x160 ft. auto sales and service station at 124-130 Brookline Ave. Estimated cost $250,000.

Mass., Brookline (Boston P. O.) — Henderson & Ross, 209 Washington St., Boston, is receiving bids for the construction of a 3 story garage at John and Pleasant Sts., here. Estimated cost $500,000. H. F. Kellogg, 278 Stuart St., Boston, Archt. Noted May 6.

Mass., Cambridge (Boston P. O.)—Industrial Bldg., c/o F. D. Leland, Kendall Bldg., Archt., is having sketches made for the construction of a 6 story factory on Commercial Ave. Estimated cost $3,000,000.

Mass., Chelsea (Boston P. O.)—Baker, Selesnick & Coplan, 22 Watts St., will build a 1 story repair and service garage at Hampden and George Sts. Estimated cost $50,000. S. E. Moffie, 51 Cornhill, Boston, Archt.

Mass., Dorchester (Boston P. O.)—S. Waldman, 101 Esmond St., is receiving bids for the construction of a 2 story, 90x120 ft. repair and service garage at Washington and Northampton Sts. Estimated cost $100,000. S. S. Eisenberg, 46 Cornhill, Boston, Archt.

Mass., Jamaica Plain (Boston P. O.)—J. Magnes, 18 Tremont St., Boston, is having plans prepared for the construction of a 1 story repair and service garage at Floyd & Basswood Sts. here. Estimated cost $100,000. S. E. Moffie, 51 Cornhill, Boston, Archt.

Mass., Lexington—M. Rubin, 294 Washington St., Boston, plans the construction of a 1 and 2 story garage at 405-421 Massachusetts Ave., here. Estimated cost $160,000. Architect not selected.

Mass., Newton (Boston P. O.)—Middlesex & Boston Street Ry. Co., 2327 Commonwealth Ave., Auburndale, plans the construction of a 1 story, 125x200 ft. garage here. Estimated cost $150,000. Private plans.

Mass., Quincy (Boston P. O.)—H. C. Murphy, 56 Franklin St., awarded contract for the construction of a 1 story, 95 x 105 ft. repair and service garage. Estimated cost $40,000. M. T. Sennison, 415 Quincy Shore Drive, Archt.

Mass., Somerville (Boston P. O.)—Boston Elevated Ry. Co., 31 St. James Ave., Boston, awarded contract for the construction of a 2 story, 45 x 145 ft. garage on Washington St., here. Estimated cost $250,000. Noted May 27.

Mass., Winchester — J. Haggerty, 734 Main St., awarded contract for the construction of a 1 story repair and service garage at 704 Main St. Estimated cost $40,000. Noted Dec. 24, 1925.

Mass., Winchester—A. T. Stewart, 286 Centre St., Newton, is having plans prepared for the construction of a 1 story, 125x145 ft. repair and service garage at 662 Main St. Estimated cost $75,000. S. S. Levy, 35 Court St., Boston, Archt.

Mich., Bay City—Gibb Welding Machines Co., manufacturers of electric arc, spot and seam welders, has work under way on the construction of addition to plant to double the capacity.

Mich., Detroit — Detroit Garages Inc., Elizabeth St., awarded contract for the construction of an 8 story, 80x100 ft. garage. Estimated cost $200,000.

Mich., Detroit—Wolverine Tube Co., 1411 Central Ave., awarded contract for the construction of a 2 story, 120x120 ft. addition to plant. Noted May 20.

N. Y., Buffalo—City, J. P. Moore, Commissioner of Parks, City Hall, will receive bids until June 22 for the construction of a garage and airplane hangars. Estimated cost to exceed $60,000.

N. Y., Queens (Jamaica P. O.)—M. O'Neil Supply Co., 25 Cliff St., New York, manufacturers of iron pipe, awarded contract for the construction of a 1 and 2 story, 58x100 ft. factory at 4617-4625 Flushing Ave. here.

N. Y., White Plains—R. E. Farley, 342 Madison Ave., awarded contract for the construction of a 2 story repair and service garage. Estimated cost $150,000.

O., Akron—City, W. F. Peters, will receive bids until June 22 for the construction of a 1 and 2 story garage and office on Johnston St. Estimated cost $150,000. Good & Wagner, Mohawk Bldg., Archts. M. P. Tucker, Municipal Bldg., Engr. Noted Mar. 4.

O., Chillicothe—Dept. of Public Works and Highways, is having sketches made for the construction of a 1 story, 100 x 145 ft. garage and repair shop. Estimated cost $75,000. H. B. Briggs, Ohio-Hartman Bldg., Archt.

O., Cleveland—The Rex Products Co., F. B. Wadhams, 5606 Euclid Ave., manufacturers of screw products, awarded contract for the construction of a 1 story, 69x168 ft. shop at 1916 East 55th St. Estimated cost $50,000.

O., Cleveland—F. R. Walker and A. H. Tashjian, c/o Walker & Weeks, 1900 Euclid Bldg., Archts., is having plans prepared for the construction of a 2 story, 76x376 ft. auto sales and service station at 2408 Prospect Ave. Estimated cost $500,000. Jones-Finney Co., 3720 Prospect Ave., Lincoln dealers, lessee.

O., Cleveland—The White Motor Co., W. C. White, Pres., 842 East 79th St., awarded contract for the construction of a 1 story, 150x160 ft. addition to factory. Estimated cost $90,000. Noted June 10.

Pa., Philadelphia—I. Fischman & Sons, 312 South 4th St., manufacturers of soda water apparatus, will build a 3 story, 22 x 100 and 20 x 24 ft. plant. J. Naschold, 5234 North 2nd St., Archt.

Pa., Pittsburgh—American Brake Shoe & Foundry Co., 505 Preble Ave., will build a 1 story, 43 x 45 and 29 x 39 ft. addition to foundry. Estimated cost $50,000. Private plans.

R. I., East Providence (Providence P. O.) City plans the construction of a 1 story repair and service garage on Lynn Ave. Estimated cost $40,000. Architect not selected.

Tenn., Nashville—Thomas Henry & Sons Inc., Trenton Ave. and Tioga St., Philadelphia, Pa., awarded contract for the construction of a 120x500 ft. factory and 100 x200 ft. warehouse including machine shops, etc. at 63rd and Centennial Blvd. Estimated cost $250,000.

Wis., Racine — Standard Foundry Co., 1600 Kewaunee St., is having plans prepared for the construction of a 1 story, 112 x 240 ft. foundry. Estimated cost $150,000. A. A. Wickland & Co., 5 South Wabash Ave., Chicago, Ill., Archt. and Engr.

Wis., Two Rivers—Hamilton Mfg. Co., manufacturers of steel printers' cabinets, etc., will soon award contract for the construction of a 3 story, 70x151 and 65x135 ft. addition to plant. Estimated cost $80,000. Lockwood, Greene & Co., 400 North Michigan Ave., Chicago, Ill., Engrs.